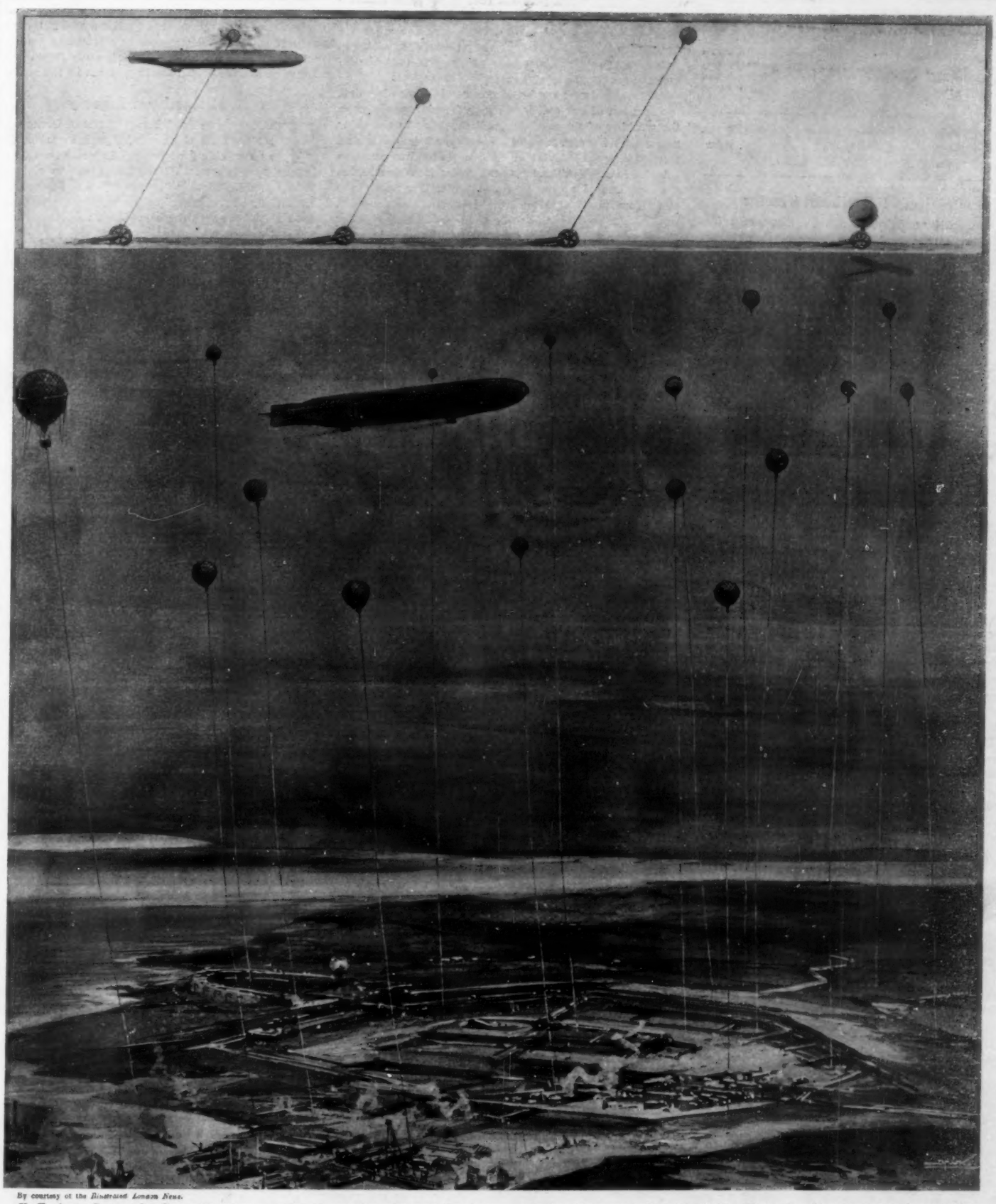
SIXTY-NINTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVIII. NUMBER 24. ★ NEW YORK, JUNE 14, 1913 ★ [PRICE 10 CENTS $3.00 A YEAR



By courtesy of the *Illustrated London News.*

Ex-Engineer Commander George T. Simmons, R.N., suggests the mining of the air as an effective defense against aerial attack. These air mines are not to be exploded by contact, but are to be set off at the will of observers on watch for that purpose.

MINING THE AIR.—[See page 538.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, JUNE 14, 1913

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
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Subscription Rates

Subscription one year $3.00
Postage prepaid in United States and possessions, Mexico, Cuba, and Panama
Subscriptions for Foreign Countries, one year, postage prepaid, 4.50
Subscriptions for Canada, one year, postage prepaid, ... 3.75

The Scientific American Publications

Scientific American (established 1845) . . . . . per year, $3.00
Scientific American Supplement (established 1876) . " " 5.00
American Homes and Gardens . . . . . " " 3.00

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Problem of the Small Tractor

MODERN conditions demand the use of a bigger, faster, and more economical unit for farm work. That is why the tractor has come to take the place of the horse. But how big shall we make the tractor—the modern farm horse?

In the United States there are nearly five million farms of less than 150 acres as compared with a million and a half larger than that. Most farmers are men of small business. There is the greatest human interest, then, in a tractor of the size that will fit the smaller farms, the farms that are operated with from four to eight horses. The small tractor, as understood by the public, is one that will fit into the conditions where not over six or eight horses at most are used to do all the farm work.

The farmer enjoys a great measure of independence. He is regarded as the last defender of individualism. Neither he nor the average person looks kindly upon any evolution that will rob him of his present status. Public sentiment is in favor of retaining the small farm, and preventing the encroachment of the big farm and of capitalistic control. The question, then, is of vital human interest, as to whether the tractor shall be reduced in size to take the exact place of the horse, or whether, in response to an economic demand, it shall grow as large as the natural limitations will allow. It is the old story—whether or not the instinct of self-preservation shall yield to the modern corporate idea of preservation through organization, the division of labor, and the methods possible only when men work together in larger groups.

It is probable that the small tractor pulling two or three plows, will some day be widely adopted. A great many more men can raise $1,000 to $1,200 to buy a small machine, than $1,600 to $3,000 to buy a big one. The market for a small tractor, once the mechanical and economic difficulties are brought down to an attractive minimum, is enormous. Sales will naturally be easier, and the lack of a satisfactory system of agricultural credit may operate to curtail the sales of the larger power units, even where financial interest and good business judgment would prompt the buying of larger equipment.

The question of how large a tractor can grow in size is apparently settled already by inflexible agronomic conditions. The weight that can be concentrated in a compact, mobile power-plant, is limited by the fact that the soil of the fields must bear the burden and still raise crops. The railway can increase the size of its engines safely by putting on heavier rails. The soil, however, will support only a given weight without injury to its physical condition. And again, there is an engineering problem, that of moving a heavy mass economically when the soil has been softened by rains. Moreover, communities have built roads and permanent bridges to sustain only what have appeared to be the heaviest tractors that are now feasible, and in the years to come, a fifteen-ton tractor will probably be the largest that can prevail.

It is too early to state what will be the final outcome. In the opening of new countries, it is safe to say that tractors will be built as large as natural limitations will permit. We have even seen instances of the combination of several large tractors ahead of a single huge plow, also built up of units in order to accomplish greater results with the saving of one or more plowmen. In view of the present great commercial successes and the trend of agricultural economics, it is reasonable to assume that a tractor of medium size, handling four to six plows, will be in greatest demand, and will do the bulk of the work for large farms and farming communities. It is equally evident that in countless cases there will be a field for the small tractor, even though its cost and operating expenses are proportionally higher than for the larger machines. Finally, many special adaptations of the small tractor will be made to accomplish certain functions where the margin of profit is large enough to overcome a natural increase in complexity and cost.

However, a revolution is taking place in the size and management of the farm. With every census the number of non-resident farm owners is increased. Furthermore, omitting the suburban truck patch, the farm is growing larger, even in prosperous agricultural States. The larger enterprises attract a higher caliber of proprietor and manager, and as in all business, the type of organization prevails that allows the exercise of the highest intelligence and mechanical power as opposed to mere manual labor. It is hard for the average person to see that the individual small proprietor is losing ground. Yet the whole tendency is toward centralization.

There is a deep-rooted and commendable feeling that the solution of our soil fertility problems depends upon the working of the land in small units, as in the older nations of Europe. Small farms, hand methods and intense personal interest in the soil, do tend to conserve this fertility. Yet the large enterprise in which brains and mechanical power play the controlling part, save men from physical drudgery. Here in America men are now far too valuable to be used in furnishing power to till the soil. Men are too costly to be used in holding back evolution. And it is to be hoped that the time is far distant when the struggle for existence in America will so cheapen human labor that the mere conservation of the soil will count at least as much as the uplift of the individual.

After all, the soil is not the only resource to be conserved. We need men now in all our industries to take the products of the soil, the mine and the forest, and make them more valuable by the expenditure of increasing skill and labor in factories. The mere production of raw material is not a matter so much for the exercise of skill as for the use of quantity methods, resulting in cheaper costs. The shaping of materials for consumption is a matter of skill for which we now pay vast sums annually to foreign countries—balancing the bill with increasing drafts upon our natural resources. The laborers we release from the soil can all find legitimate employment in another phase of conservation.

The Japanese and the American Navies

IT is a matter of particular importance at the present juncture, in view of the recent crisis, that the people of American should take serious stock of Japanese naval development. The navy of the United States is still incomparably superior to that of Japan; but its superiority is very largely dependent upon ships built during what is known as the "pre-dreadnought" era, and which are therefore in a state of ever-increasing obsolescence. The future cannot be guaranteed by a preponderance of units which, whatever their merits when they were built, are now wholly outclassed. The Panama Canal, while it will add to the mobility of the American fleet, increases its responsibilities. The canal affords the navy a shorter route to the Pacific, but it also adds to the dangers that the United States may run in the Pacific. Four years ago M. Sartori Kato, one of the best-informed of Japanese publicists, wrote in an English naval periodical: "Whether allowed or disallowed, Japan's insistent aspiration is to be mistress of the Pacific." It will be wise to bear the policy in mind when considering the facts which may be regarded either as the outcome of it or as contributing toward it.

On another page in this issue a comparison of the American and Japanese fleets will be found. The United States has thirteen dreadnoughts built and building to Japan's twelve. The difference in tonnage, such as it is, is slightly in favor of Japan. In gun power the Japanese are 15 per cent better off than we, although they have one dreadnought less.

There is in these facts no cause for panic. Japan has still, at the outside, only five completed dreadnoughts to the eight of the United States; and, taking into consideration the more rapid rate of construction in this country, there is no good reason why the proportion should be altered. It is, however, perfectly clear that the naval superiority of America over Japan cannot be maintained by laying down one battleship a year. From 1911 onward Japan has laid down or ordered eight dreadnoughts to the four of the United States, and another four battle-cruisers, besides minor craft, are provided for in the new Japanese programme. When Admiral Takarabe was placing the new programme before the Lower House of the Japanese diet, he declared that it had been prepared with an eye to the 21 battleships which "a certain Power" might be able to oppose to it. This was, of course, a direct reference to the United States, since no European power is in a position to risk the dispatch of so many ships to so distant a station. It must have become perfectly obvious to every man who examines the situation that a provision of one battleship a year will not suffice to maintain the position of the United States among the naval powers of the world. Between 1901 and 1907, a period of seven years, 29 armored ships were launched for the United States fleet. In the five and a half succeeding years only ten have been launched. No nation can expect to maintain its position in face of such facts as these. With the advent of the dreadnought, costing more to build and to keep up than ships of earlier types, some diminution in numbers was to be looked for, but there is no nation that has reduced its rate of construction to such as extent as the United States. At the end of the pre-dreadnought era the United States was easily second to Great Britain. Germany has now usurped that position, and if the present rate of comparative progress is allowed to continue, it will not be long before the rise of Japan compels America to take a still lower position in the scale.

Research on Leprosy

THE work of Prof. Raoul Pictet of Geneva (Switzerland) on the use of liquefied carbon dioxide as a specific for leprosy, has lately been discussed in the newspapers. Wholesale cures are claimed for it in Hawaii. Pictet's "discovery" is a method of cauterization, but whether more effective than other long used methods along the same lines remains to be seen.

Until recently, leprosy had not been produced in animals for purposes of experimental study; and it is barely four years since the germ was first isolated at the Louisiana Leper House. The work of Duval and Couret in the laboratories of Pathology and Bacteriology at Tulane University (New Orleans) has given a new and sure foundation for future investigation of this disease.

They have established that leprosy cannot be given to any animal by a single injection of its germs; repeated injections are necessary in order to make the body sensitive. This is doubtless true of human beings, and explains the relative infrequency of leprosy even when persons have lived among lepers for some time.

This is in agreement with a long line of new theories regarding the *modus operandi* of infection. Typhoid germs take two weeks to make the body sensitive enough to give the disease a start. During this period of incubation millions of germs may be produced in the course of forty-eight hours, but the disease is not produced until the body reacts. In leprosy, it would seem that the germs are repeatedly killed off by the body.

Duval says that "to produce the disease experimentally, it seems necessary to give the animal repeated injections of large numbers of leprosy bacilli at given intervals for a period of months." His research shows that an injection of first four *million* and later of four *billion* bacilli were given before the disease "took." Even after the first injection of four million bacilli and for nearly two weeks after the injection of the culture containing four *billion* "there was no evidence of either localized or general infection." The animal first infected with leprosy was a monkey (*Macacus rhesus*), the initial injection being given October, 1910. It was not until the following March that he was recognized as afflicted with a disease having all the clinical characteristics of "human leprosy," and death did not ensue until December.

Counting the Waves of the Sea

MANY seismologists believe that certain types of microseisms, those of a period of say from four to seven seconds, are due to the pounding of ocean waves on the seashore. In order to test this idea more fully the International Seismological Association, in 1909, voted 1,000 marks to be used by its committee on microseisms in constructing an instrument for registering ocean waves. This "undagraph," as it is called, has now been built, and is described by Dr. Otto Klotz in the *Bulletin of the Seismological Society of America*. The original undagraph was set up in 1911 at Tynemouth, England, on the North Sea; but a location more exposed to the full force of ocean waves has now been found at Chebucto, outside the harbor of Halifax, N. S. An open iron pipe extends into the sea with its mouth below the lowest stage of the tide or wave trough. The other end of the pipe is on land, and is so arranged that, with each incoming wave, the water rises, compresses the air above it, and bulges a diaphragm, which actuates an electrical recording apparatus. The period of the waves is thus registered, but there is not, as yet, any arrangement for registering their amplitude. The recording apparatus will be installed in a lighthouse, and the records obtained will be compared with those of a Bosch seismograph at Ottawa.

Electricity

Electrification on Swedish Railroads.—"Electrification of the lines of the Swedish State railroads from Kiruna to Riksgränsen, says the *Electrical World*, is nearing completion, and the government is now planning the electrification of the large trunk lines from Stockholm to Malmö and from Stockholm to Gothenburg. The former line will receive energy from a plant to be built by the government near the town of Motala, and for the southern part energy will be purchased by the government from a large central station on the river Lagan. The Gothenburg line will be supplied chiefly from the government's plant at Trollhättan. Later the line from Gothenburg to Malmö will also be electrified. The cost of the lines at present under consideration will be nearly $30,000,000. The transmission lines, transformer stations and locomotives will cost approximately $20,000,000 and the new generating station will cost in the neighborhood of $10,000,000."

Central Station Investment.—It is estimated that investment in the central station industry is capitalized to-day at about $2,500,000,000 and that the earnings are apparently estimated around $350,000,000. Quoting from the report of Mr. T. C. Martin, editor of the report of the Committee on Progress before the 1912 convention of the National Electric Light Association, "There can be no great exactness to these estimates, as the general census of the central stations will not be taken until next year, and the last United States report is that of 1907." It is apparently estimated by those who ought to know that the central station income is somewhere around $400,000,000. The *Electrical World* in its issue of January 4th, 1913, gave the following data on the electrical industry:

Value of electrical apparatus made	$350,000,000
Electric railway earnings	635,000,000
Central station earnings	450,000,000
Telephone earnings	350,000,000
Telegraph earnings	85,000,000
Isolated plant service	125,000,000
Miscellaneous electric service	125,000,000

Making a grand total of approximately $2,120,000,000.

The Naples Subway.—According to further details which have appeared as to the construction of the metropolitan electric road for the city of Naples, the franchise for this line was granted last January and it will be built partly as a surface traction road and part in subway, according to the plans now in preparation by the Franco-Italian company, the organizers of the enterprise. The length of the line is to be about five miles, and it will have fifteen stations. In some places the road will run at quite a depth underground, this being near forty feet in some cases, so that it is intended to put in electric elevators at these points. The whole of the line will be laid in double track standard gauge, with a minimum radius of curves of 330 feet in the surface line and 130 feet in the subway. The greatest distance between stations is 1,880 feet. For operating the electric road there is used a third rail of 75 pounds per yard and it carries 1,000 volts direct current for the motors. Each train is made up of three cars, at least at the first period of operating, with a motor car fitted for second-class passengers at each end and a trailer for first-class in the middle, and the train will be controlled from either of the end compartments on the multiple-unit control system. Four 50 horsepower electric motors form the outfit of the motor car and the standard speed is under 15 miles an hour.

Pipe-line Telephony in Mines.—A German electrical engineer, O. Dobbelstein, is responsible for the statement that a telephone system can be made to work from the interior of a mine to the surface of the ground by simply connecting one side of the telephones to the various metal parts such as compressed air or water pipes, cables, rails and the like, while the other side is connected to earth, in spite of the fact that all the piping, etc., is of course already in connection with the earth. It appears that a system of the kind is now in use in the Carolinienglück mine near Bochum. The expense of putting in telephones on this plan is of course reduced to a minimum from the absence of any wires, so that quite an advantage is had. A battery supplying 12 volts is all that is needed to supply the current for the microphone, using an induction coil in the secondary circuit. An ordinary telephone is used as the receiver. An electric bell cannot naturally be used on this system in order to give signals, as only telephone currents can be carried. However, a method can be applied in the shape of a mono-telephone relay such as is used on the Mercadier apparatus. This consists of a metal disk which vibrates when current comes into its magnet, and the vibration works a light arm so as to make an electric contact in a suitable way, putting on a local battery circuit to ring a bell, so that signals can be made in this way by the telephone itself. Both permanent and portable telephone sets are used within the mine, and the latter are set up at once by connecting to the rails or pipes and to the ground. Telephones can also be installed in the elevators by making use of the cable as the metal part.

Science

Biological Research in the Philippines.—A large and well-equipped biological expedition organized by the University of the Philippines and the Philippine Bureau of Science left Manila on April 5th, under the leadership of Prof. Griffin, for Taytay Bay, on the northeastern coast of the island of Palawan. It was planned to spend two months in an entirely unexplored region.

Earthquakes and Rainfall.—An apparent relationship between the frequency of earthquakes at Tokyo and the amount of rainfall and snowfall in northwestern Japan has been pointed out by Prof. Omori, who does not, however, attempt to explain it. The periods when earthquakes are infrequent (but severe) coincide in a striking manner with those when rainfall is deficient at Niigata and Akita; while the periods of frequent (but not violent) shocks coincide with excessive rainfall at those places.

Production of Argon from Hydrogen.—At a lecture delivered on June 1st at the Chemical Institute in Rome, Sir William Ramsay announced that he had obtained argon by the action of cathode rays upon hydrogen in a vacuum bulb with aluminium electrodes. The anode was covered with a thin layer of sulphur. A somewhat similar experiment in which selenium was used in place of sulphur gave krypton in place of argon. Sir William Ramsay does not consider the results of these experiments as final, but is awaiting further confirmation.

Dr. Mawson is now in more or less regular communication with the world by wireless telegraphy *via* the station established by his expedition at Macquarie Island. For nearly a year after his arrival in Antarctica the wireless outfit set up at his base, in Adelie Land, failed to work properly owing to troubles with the gasoline motor that was intended to run the dynamo, and the repeated overthrow of the antenna masts by severe storms. A recent wireless message states that he and his companions are beguiling their time, during their present involuntary sojourn in the South, by publishing a newspaper named the *Adelie Blizzard*. In the middle of May their hut was already nearly snowed up, and penguins and seals had disappeared shortly before the bay became frozen over.

Antarctic Explorers in London.—Commander E. R. G. R. Evans, R.N., C.B., told the story of the Scott expedition at Albert Hall on May 21st, before an immense audience comprising the fellows of the Royal Geographical Society and their friends. Lord Curzon presided. The address, as published in the London *Times*, includes several interesting details not previously made public. Captain John K. Davis, commander of the "Aurora," the ship of Dr. Mawson's Antarctic expedition, recently visited London to report the progress of the expedition and to endeavor to obtain part of the money that is necessary to cover the extra season's work in the Antarctic. Mawson and his little party are now sending daily weather reports by wireless from Adelie Land to Australia.

The Schröder-Stranz Expedition.—The precarious situation of this expedition to Spitzbergen was fully reported in the SCIENTIFIC AMERICAN of April 5th, 1913, page 313. From subsequent press reports it appears that the Norwegian relief expedition under Capt. Staxrud succeeded in reaching Treurenberg Bay, in northern Spitzbergen, where Schröder-Stranz's ship was frozen up all winter. Most of the German party, after the attempt to proceed overland to Advent Bay, had returned to the ship; but Detmers and Moeser were reported drowned, Eberhardt had been frozen to death, Stave had died of illness, Rüdiger, the oceanographer, had been severely frost-bitten and had lost a foot, and no tidings had been received from Lieut. Schröder-Stranz and his three companions, who embarked on a sledge expedition last autumn.

A Good Idea in Names.—Long-winded German names are something of a trial to the world at large, but the Germans themselves appear to have found the remedy. In 1909 an international aeronautical exposition was organized at Frankfort-on-the-Main. Its full name in German was "Internationale Luftschiffahrt-Ausstellung." After being abbreviated to "I. L. A.," this ultimately became "Ila;" and as the "Ila" the exposition has since been universally known. In like manner the "Allgemeine Luftfahrtzeug-Ausstellung" held last year in Berlin was known as the "Ala;" and now we hear of the "Damnu," which, to the busy man, is a happy substitute for "Deutsche Ausschuss für den mathematischen und naturwissenschaftlichen Unterricht." "Imuk," which signifies Internationale mathematische Unterrichts-Kommission, and "Datsch," a condensation of Deutsche Ausschuss für technische Schulen. Of course, this method of syncopation has its limits; since many combinations of initials are unpronounceable, while others might be too grotesque to be palatable. On the other hand, it seems likely that in future the names of many expositions, societies, and the like will be deliberately selected with reference to such abbreviation.

Aeronautics

A Medal for Capt. Chambers.—Capt. W. I. Chambers, head of the aeronautical department of the navy, was presented with a gold medal recently by the Aeronautical Society. This honor was awarded because he was the first to demonstrate the use of the aeroplane as an auxiliary to the navy. Capt. Chambers' apparatus has been described and illustrated in the columns of the SCIENTIFIC AMERICAN.

Counteracting the Cyclonic Action of Air.—In a patent, No. 1,060,273, Chester B. Melott of Yonkers, N. Y., has patented an aeronautical apparatus which has supporting and controlling surfaces with propelling means whose axis is parallel to the line of flight. Some of the surfaces extend radially from the said axis and adjacent to the propelling means so as to resist the cyclonic action of the air set in motion thereby, and means are provided for adjusting some of the radial surfaces substantially around the axis.

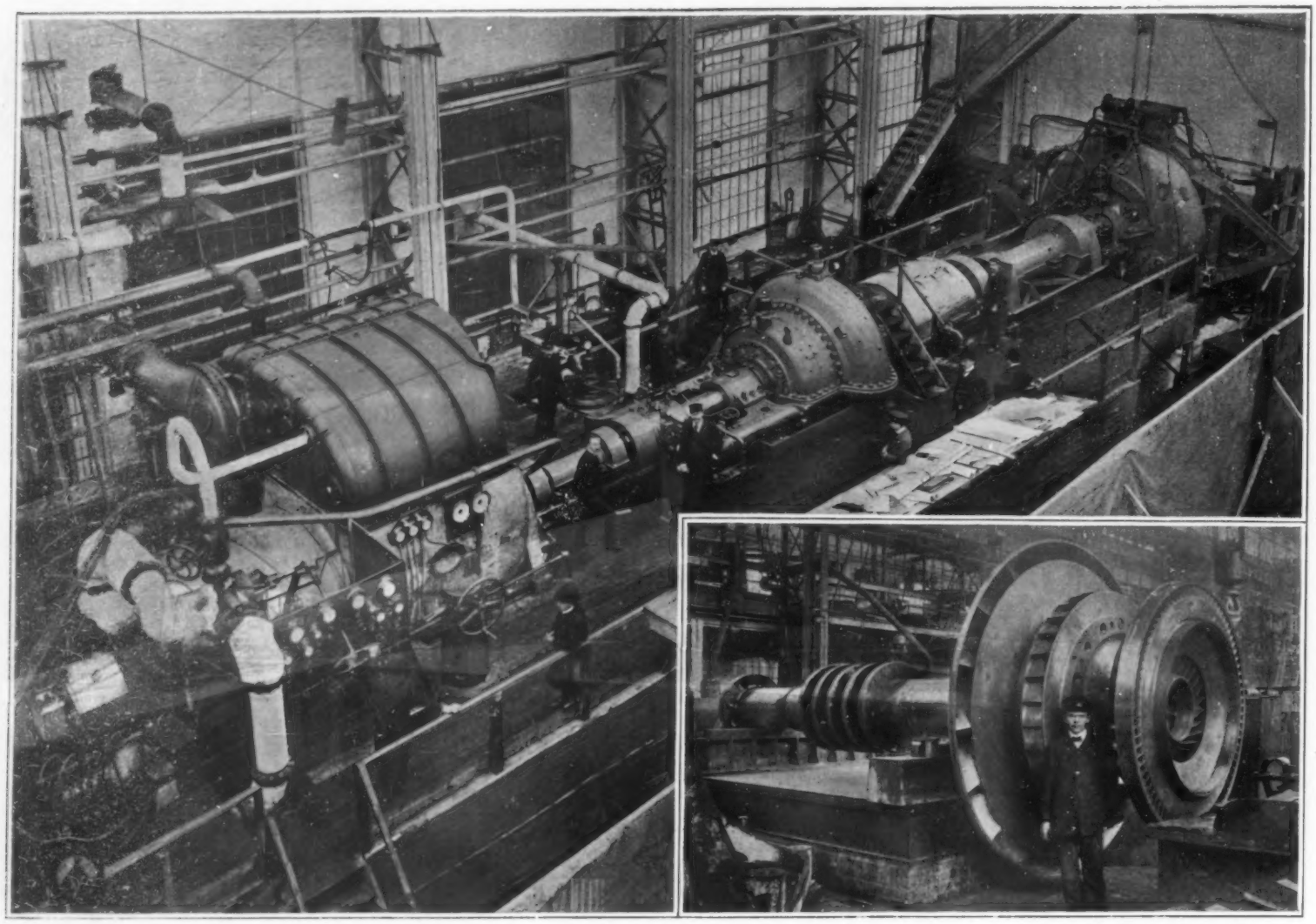
System of Aeroplane Control.—A patent, No. 1,058,422, is issued to Edson F. Gallaudet of Norwich, Conn., in which the main supporting wing surfaces of an aeroplane are provided with auxiliary surfaces which are mounted forward and aft at or near the tips of the wing surfaces, and these auxiliary surfaces are actuated differentially to change the relative areas of the front and rear sections of the wing surfaces by projecting the auxiliary surfaces either forwardly beyond the entering edge or backwardly beyond the trailing edge of the wing surface.

Antarctic Coal.—According to Prof. D. W. Edgeworth David, of the University of Sydney, Australia, the deposits of coal discovered by the Shackelton and Scott expeditions in the Antarctic will perhaps prove to be one of the largest unworked coal fields in the world. Wild, of the Shackelton expedition, discovered seven seams of coal outcropping in a great cliff face of sandstone and shale. The thickness of these seams, inclusive of a few clay bands, was 7 feet. Specimens chopped out by Wild with his ice ax have been analyzed at Sydney and show the coal to be of workable quality. Scott's geologists traced this field for a distance of 650 miles, extending northward from the head of the Beardmore Glacier.

Balancing Devices for Aeroplanes.—In a patent, No. 1,058,712, to Ashley C. Bennett of Minneapolis, Minn., assignor of one half to Ralph D. Wilcox of Minneapolis, is shown in connection with the lifting plane of an aeroplane, balancing planes arranged at the outer ends of the lifting plane and in pairs, one in advance of the other, and arranged to be projected alternately laterally beyond the lifting plane, the forward ones of the balancing planes having depressing effect and the rear balancing planes having an elevating effect, and these balancing planes are connected with each other, so that when one set of balancing planes is operated the other set will be actuated also.

The French Chamber recently voted a credit which is to be used for adding to the apparatus of the St. Cyr Aerotechnic Institute, near Paris, this establishment forming part of the University. The committee decided that the amount should be used for constructing a dynamometric balance of large size for mounting upon the electric car which runs upon the track in the grounds for testing aeroplane surfaces, so as to allow an entire aeroplane to be used upon the car. In the second place, the round building and its experimental track is to be fitted with an electric-motor apparatus placed upon a central pivot so as to rotate objects around the track in order to study the resistance of the air, such as models of surfaces or helices. By means of the electric outfit, variations of speed can be easily made. A large air blast apparatus is also to be installed for testing small models in a fixed position in a strong air current which can run as high as 90 miles an hour. The first two apparatus will be installed so as to be at work during the coming visit of the Senate aviation commission.

The Aeroplane Industry in Germany.—The *Berliner Tageblatt* gives the following *résumé* of the situation of aeroplane manufacture in Germany, and from this it appears that matters are far from being in a flourishing condition, at least from a financial standpoint. At present there are thirty-five aeroplane construction works, not counting amateur construction, but in nine out of ten cases the orders come from the government and only go to two or three leading firms. In fact, the pilot officers are only trained to use two or three systems of aeroplanes, and it is not considered practical in time of war to use too many kinds of flyers. On the other hand, it was hoped that an extensive market would be secured by the proposed founding of aeroplane posts in the colonies, but this promise is not likely to be fulfilled at present. The constructors also expected much from the national aviation funds and the recently demanded credits for aeroplane work, but it appears that the distribution of the funds ruined their hopes, at least in part. A few of the leading factories still continue to absorb the orders for aeroplanes. The journal concludes that in its *ensemble*, at least, the situation of the German aeroplane industry is in a very critical state.



Föttinger transformer of ten thousand horse-power for ship propulsion installed on the Vulcan-Werke's testing floor with steam turbine and Föttinger brake. The insert shows the rotor of a ten thousand horse-power hydraulic transformer for marine service.

Tests on a 10,000 Horse-power Föttinger Transformer

Hydraulic Gear for Marine Turbines

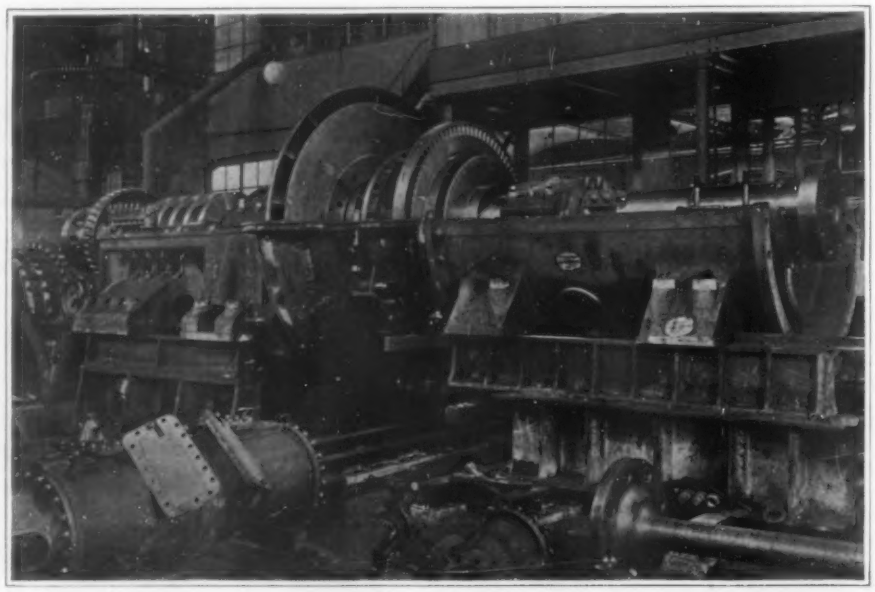
By Dr. Alfred Gradenwitz

IT will be remembered that the Föttinger transformer is an hydraulical transmission gear intended to transmit loads up to the highest figures from a motor shaft to another shaft coaxial with the former. It can be designed for an equal number of turns of both shafts or for transformation into lower or higher speeds, for the same or an opposite direction of rotation; and it thus constitutes a reversing gear which allows the driven shaft to be reversed while the driving shaft continues working as before. The principle of transmission can be briefly described as follows: A rotor mounted on the primary shaft is designed as a high-grade centrifugal pump, lifting water which in the water wheels mounted on the secondary shaft, works under similar conditions as in hydraulic turbines. By a skilful combination of these wheels, Dr. Föttinger has produced a compact gearing of remarkable safety in operation and satisfactory life, in connection with which any losses due to hydrodynamical transmission are reduced to a minimum.

In view of these special features of the Föttinger transformer and the advantages it shares with all hydraulical machines, it is especially adapted to serve as an intermediate gearing on board ship, between the steam turbine and the propeller. It is well known that the economical speed for marine steam turbines is much higher than that desirable for the propellers driven by the turbines. The interposition of the transformer between the turbines and the propellers enables both to be driven at the speed which gives for each the highest economy.

Interesting tests were recently made on the testing floor of the Hamburg turbine factory of the Vulcan-Werke, which were intended to demonstrate the suitability of the Föttinger transformer for the very largest outputs. A reversible transformer of 7,800 horse-power normal output, intended for the propulsion of a large transatlantic steamer of one of the big German shipping companies, was submitted to a continuous test of 14 days' duration, at high loads (5,000 to 10,000 horse-power). The arrangement of these tests was as follows:

A steam turbine of the Curtis-A. E. G.-Vulcan system was installed on the testing floor, the primary of the transformer being coupled to the turbine. The secondary energy was braked by a large hydrodynamical Föttinger brake designed for a maximum output of 15,000 horse-power, the propeller thrust being replaced by an hydraulical axial thrust so that the transformer was actually operated under the same conditions as it will eventually be in the vessel. Between the driving turbine and the transformer on one hand and the transformer and the brake on the other were inserted torsion gages for determining the primary output and checking the secondary output as indicated by the brake. The normal output of the transformer corresponds to 800 revolutions per minute of the primary shaft and 160 revolutions per minute of the secondary shaft.

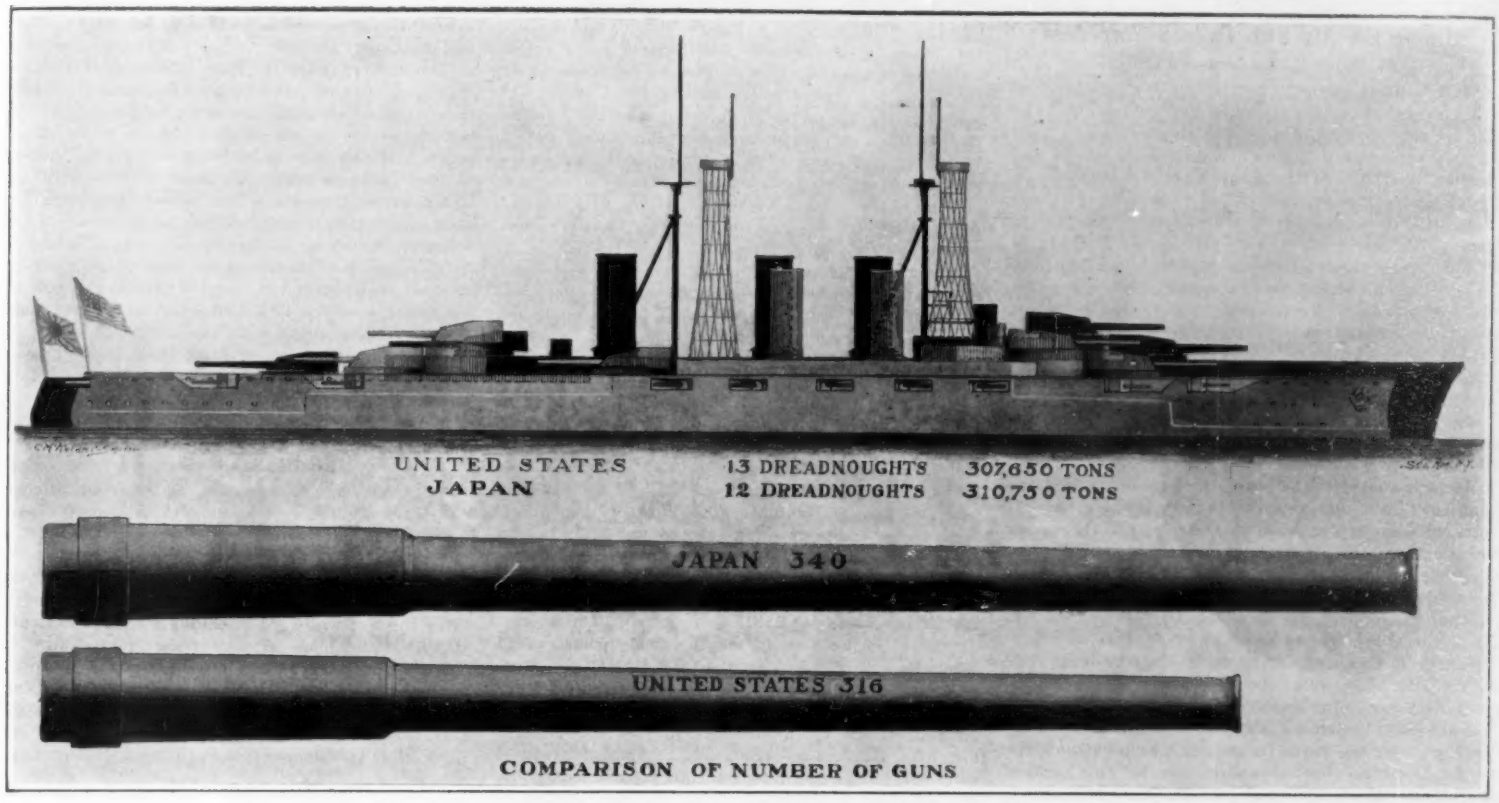


General view of a ten thousand horse-power Föttinger transformer for ship propulsion.

These tests have shown the efficiency of the transformer to be up to 90 per cent. The transformer was found to work with absolute smoothness, without any vibration or noise, reversals being effected with astounding rapidity and safety. The speed of rotation of the turbine, even during reversals, was kept permanently within given limits by means of a centrifugal governor.

It may be as well in this con-

(Concluded on page 549.)


UNITED STATES 13 DREADNOUGHTS 307,650 TONS
JAPAN 12 DREADNOUGHTS 310,750 TONS
JAPAN 340
UNITED STATES 316
COMPARISON OF NUMBER OF GUNS

Graphic comparison of Japanese and American dreadnoughts and their armaments.

The Japanese and American Navies Compared

How Japan is Outstripping America

By Percival Hislam

AT this moment the principal Japanese warships in service are the battleships "Satsuma" and "Aki" and "Kawachi" and "Settsu." The first two, though not dreadnoughts in the strict sense of the word, are certainly entitled to rank as such. The "Satsuma" displaces 19,350 tons and carries four 12-inch, twelve 10-inch, and twelve 4.7-inch guns, while the "Aki" displaces 19,800 tons and has eight 6-inch in place of the 4.7-inch weapons. The other two ships are typical dreadnoughts, displacing 20,800 tons and carrying twelve 12-inch guns apiece. In addition to these ships the battle-cruiser "Kongo" has just completed her trials after construction in England by the Vickers firm. She is a ship of 27,500 tons, with a designed speed of 27 knots, and is armed with eight 14-inch and sixteen 6-inch guns. The significance of the fact that Japan has a ship with 14-inch guns completed several months before the "New York" and "Texas" are due to be completed, ought not to be overlooked.

Besides these ships, Japan has actually under construction the battle-cruisers "Haruna," "Hiyei" and "Kirishima," and the battleship "Fuso." The first three are sister ships to the "Kongo;" and the "Fuso," although her details have not been officially published, is understood to have a displacement of 30,000 tons and to carry an armament of ten 15-inch guns. These four ships are all building in Japan—a fact which itself speaks volumes for the progress made by that nation in recent years. Not one of the battleships or armored cruisers that took part in the campaign against Russia less than ten years ago was native-built; but since then Japanese yards have completed four battleships averaging 20,000 tons, and four armored cruisers, of which two displace 13,750 tons and two 14,600. It is true that a good deal of the material used in the construction of these ships was imported, but the percentage of imported material has diminished considerably. For the battleship "Satsuma," completed in 1910, 61 per cent of the material was imported, but for the "Kawachi," completed in 1912, only 20 per cent. This means that Japan is rapidly becoming a self-contained nation so far as naval construction is concerned.

During the past few weeks three more battleships have been ordered—all in Japan. One is to be built at Yokosuka (dockyard), one by the Mitsubishi Company (Nagasaki), and one by the Kawasaki Dock Company (Kobe). In bringing the new programme before the Lower House, Admiral Takarabe, "Vice Minister of Marine," stated that the original scheme prepared by the Navy Department provided for the construction of 8 battleships, 8 battle-cruisers, 16 scout-cruisers and 48 destroyers. This, however, would have cost $270,000,000, and the finances of the country were not in a position to stand such an outlay; and it had therefore been decided to reduce the programme to 8 battleships, 4 battle-cruisers, 8 scout-cruisers and 40 destroyers. It was definitely stated that this did not include the ships at present under construction, and that the total cost was estimated at $196,300,000. As a preliminary step toward the execution of this scheme it had been decided to lay down three battleships at once, and these are the sister ships to the "Fuso," referred to at the beginning of this paragraph.

Reckoning as dreadnoughts the battleships "Satsuma" and "Aki," the present dreadnought strength of the Japanese navy is five ships completed and seven under construction or on order. The corresponding totals for the United States are eight ships completed and five on order, giving a numerical superiority of 13 to 12 in favor of the United States. This is admittedly backed up by a great advantage in "pre-dreadnought" ships; but these are quickly dropping out of the scale of naval power, and no nation that looks a yard in front of its own nose will be deluded into placing more reliance upon them than they are really worth. The future, so far as the eye can see it with any certainty, is with dreadnoughts, and of dreadnoughts the United States has 13 ships built and building to Japan's 12.

Examining these totals more closely, the position is not so favorable as even this niggardly margin would indicate. The following table gives the tonnage of the vessels concerned:

UNITED STATES.		JAPAN.	
Ships.	Tons.	Ships.	Tons.
2 Michigans	32,000	2 Satsumas	39,150
2 Delawares	40,000	2 Kawachis	41,600
2 Floridas	43,650	4 Kongos 110,000	
2 Wyomings	52,000	4 Fusos 120,000	
2 New Yorks	54,000		
2 Nevadas	55,000		
1 Pennsylvania...	31,000		
13 Dreadnoughts..307,650		12 Dreadnoughts..310,750	

So far as tonnage is concerned—and tonnage is usually reckoned as expressing fighting power in one form or another—the twelve Japanese dreadnoughts built and building are therefore superior to the thirteen of the United States. In comparing gun-power the figures are naturally more complicated; but if the statement, generally accepted, is right which credits the Japanese "Fuso" class with ten 15'-inch guns, the comparison as regards the dreadnoughts tabulated above is as follows:

Caliber.	United States.		Japan.	
15-inch	..		40	
14-inch	52	132	32	128
12-inch	80		32	
10-inch	..		24	
6-inch	..		156	
5-inch	208	208	..	188
4.7-inch	..		32	

Among the Japanese guns, the projectile of the 15-inch weighs 1,950 pounds; of the 14-inch, 1,400 pounds; of the 12-inch, 850 pounds; of the 10-inch, 500 pounds; of the 6-inch, 100 pounds; and of the 4.7-inch, 45 pounds. Measuring gun-power on the basis of one round fired from each gun, it will be found that the Japanese dreadnoughts are superior to the American by 179,040 pounds of metal to 154,880 pounds. Measured by the usual scale of dreanought comparisons, this indicates a Japanese superiority in gun-power of 15 per cent, in spite of an inferiority, small though it be, of 12 ships to 13.

What is a Dendrologist?

DENDROLOGIST is the name applied to one who is engaged in the study of tree botany or dendrology, which is derived from the Greek words *dendron*, tree, and *logos*, discourse, a treatise on trees. Dendrology may thus be defined as a branch of botany that treats of trees, which properly includes taxonomy, morphology, anatomy, physiology and ecology of tree species. While dendrology is a division of botany, it is far more specialized and includes a knowledge of plant life, which is seldom considered to be a part of systematic botany. One who knows botany in a general way is not necessarily a forester, but the dendrologist who has specialized in all phases of the scientific knowledge of trees, including a study of the factors which influence the life and growth of trees in their natural or adopted habitat, possesses the requisite training of a forester. A thorough knowledge of the life history of trees formed the basis for all silvicultural operations which are naturally included within the sphere of dendrological studies. The word dendrologist originated in England in the seventeenth century, and was probably used first by Evelyn in order to designate definitely the expert engaged in the study of tree botany, and dendrology in order to designate the work itself.

Mining the Air with Balloon Torpedoes

By Major H. Bannerman-Phillips

THE delivery of the "First Wilbur Wright Memorial Lecture" at the Royal United Service Institution by Mr. Horace Darwin, before the members and guests of the Aeronautical Society, reminds both sailors and soldiers that it was the great American investigator, indefatigable pioneer, and skilled constructor and aviator, who, in conjunction with his brother, Orville, first took flying out of the dreams of fancy and made it a living fact. It was inevitable that their peaceful conquest of the air should lead to its immediate utilization for purposes of war. We must face the possibility of fresh methods of warfare superadded to those with which we are already acquainted. How will these affect the attack of fortified places, more especially sea-ports and naval war-harbors?

In considering the problem of injuring coast defenses, and arsenals or storehouses containing material for refitting war-vessels, the first question which occurs to the mind is the possibility of damage by bombardment, and the shortest range to which the attacking ships can approach in order to use their guns with effect. The second is the chance that may exist of inflicting blows on such nerve-centers of the defense as, on account of their affecting the control of the defender's artillery fire or his supply of ammunition, it may be important to paralyze, if possible, as a preliminary to a more general attack.

We may infer, from the experiences of the Russo-Japanese war and from the more recent sinking of merchant vessels in Smyrna harbor—the aftermath of mine-laying during the Turko-Italian and Turko-Balkan wars—that until the sweepers and creepers of an attacking fleet have thoroughly gone over the mine-field which will cover every coastal defense of any importance, the large ships will have to move with extreme caution, and at great risk if they want to get within range of the enemy's defenses. The development of the steerable automobile torpedo, with its long range, is another question to be considered by the hostile fleet, for the local torpedo flotilla, and the submarines by day and destroyers by night, will be constantly on the lookout for the enemy's warships. Even as recently as the Russo-Japanese war the long-range torpedo had not to be very seriously reckoned with, but now it has become a potent factor.

This being so, and since an attacking fleet will have, during the initial operations at any rate, to keep at a safe distance from properly equipped harbor defenses, there will be every reason for commanders to use the air as a means of first reconnoitering, and secondly endeavoring to cripple the defenses on shore by the demolition of nerve-centers, the destruction of arsenals, setting fire to store-houses and oil tanks, and creating a depressing moral effect on the garrison.

It has been suggested that fortified places might be protected by a system of aerial mines in captive balloons to prevent airships from getting vertically over the guarded area, these being exploded either by electricity from below, or in consequence of being fouled by the attacking dirigible in its endeavor to place itself in the required position for dropping explosives.

This is the old, and inefficient, method of *passive* defense. The range of modern special airship destroying artillery is far greater than the height attainable by a dirigible, but supposing 5,000 to 6,000 feet to be a safe altitude from artillery, the object of the "mine" (captive balloon) would be to cause danger at a still higher altitude. Putting the weight of cable at 70 pounds for every 1,000 feet, it will be seen that 6,000 feet of cable would weigh 420 pounds, so that the balloon would have to lift this plus the weight of envelope, car and explosives. The weight of a captive balloon of 10,000 cubic feet capacity complete is about 250 pounds, and its lifting capacity, filled with hydrogen, is 700 pounds, or with coal gas, 375 pounds, and coal gas would preferably be used for "mine" balloons on account of the great expense of hydrogen. The weight to be lifted would therefore be $420 + 250 = 670$ pounds, without allowing for the explosives, but at a height of 6,000 feet above mean sea-level, the lifting power of the hydrogen would be reduced to 540 pounds, because the volume of air which it displaces, although the same at that altitude, is lighter and the lifting power of the gas is the difference between its own weight and that of the equal volume of the surrounding air. Therefore the captive balloon could not carry its own weight and its cable to the height of 6,000 feet, without taking into consideration the occasional increase in weight from moisture deposited by rain or dew on the envelope, which might amount to another 100 pounds.

In a fog or at night an enemy's airship, moving without searchlights for concealment, might run foul of one of the captive "mine-balloons" in endeavoring to get vertically above the protected area, but by daylight and in clear weather, and if undeterred by the presence of mobile aircraft guarding the defenses, it could fly round the area at a safe distance and destroy the "mines" by fire from its machine-guns, or by aerial torpedoes of the Unge type, worked by compressed air; the explosives carried by the mines would, if not exploded by the fire of the airship, fall upon and damage the buildings, etc., which they were intended to guard.

A high wind, or a sudden storm gust, might cause the same effect, and lightning might explode the balloon and cause the descent of the explosives with similar results, although the balloon could be connected electrically with the earth by way of protection.

If the "mine-balloons" were stationed close enough to one another to form a defensive *enceinte* or network, the wind might cause the cables to foul one another and get entangled. It does not take much wind to cause the cable of a captive balloon to assume a considerable angle with the vertical, and the farther the balloon is carried down wind, the more the cable slopes from the balloon to the ground. In a strong wind, unless the surplus "lift" of the gas is very great, the balloon is brought close to the ground and cannot rise to any height. The greater the "lift," the higher it will rise, but to obtain this, the size of the balloon must be large in proportion to the weight it has to raise, and the surface it presents to the wind and consequent difficulty in rising are increased accordingly.

On the whole, it would be more profitable to trust to the airship-destroying artillery armament of a fortress for local defense and expend the funds which would otherwise be devoted to captive balloons and explosives on strengthening the *mobile* aerial equipment; in other words, meet the menace of aircraft with still better aircraft, which could either deal with the enemy's dirigibles before they reached the guarded area, or sally out, pursue and attack them by machine-gun fire, if they came over by surprise. The moral effect of the possession of a superiority of aerial cruisers would do more to check reconnaissance and attack than the most elaborate preparations for passive defense.

The Langley Aerodynamical Laboratory

By Carl Hawes Butman

THE establishment of the Langley Aerodynamical Laboratory is a fitting and live tribute to him who contributed so much toward the solution of the problem of mechanical flight.

The laboratory is under the Smithsonian Institution, and its object is to study the problems in aerodynamics, with such research and experimentation as may be necessary to increase the safety and effectiveness of aerial locomotion for the purpose of commerce, national defense, and the welfare of man.

The laboratory was authorized by the Board of Regents at a meeting on May 1st, 1913, called especially for the report of a committee previously appointed for the consideration of this matter.

The laboratory is to be under regulations to be established, and fees to be fixed by the chairman of the General Committee, with the approval of the Executive Committee of the Board of Regents. It may exercise its functions for the military and civil departments of the Government, as well as for any individual, firm, association, or corporation in the United States, provided such department, individual, firm, association, or corporation shall defray all the expenses accruing from any such services rendered by the exercise of the functions of the laboratory. Bulletins and other publications for public distribution, containing such information as may be valuable to the Government or the public, will be issued from time to time. These publications will include an annual report which will cover the work of the laboratory and the researches of the general and sub-committees.

It was deemed advisable to have the work divided up into several departments, and members of the General Committee were designated as chairmen of several sub-committees, the exact names, functions and personnel of which have not yet been determined.

The General Committee, it is understood, will take charge in an advisory manner of all aeronautical research, experimentation and additional laboratories in which the Government may become interested or foster; in this way, it will be a general advisory committee on aeronautics. Its functions will be numerous and its scope national.

An office in the Smithsonian Building has been made available by the secretary; Dr. Alfred Zahm has taken up the office work of recorder, and is planning the publication of a hand-book intended to show the scope and functions of the committee in general, and the laboratory in particular.

The project has been financed by the Board of Regents through an appropriation of $10,000 for the present year, and $5,000 annually for five successive years.

A valuable adjunct to the office of the committee is the library relating to aeronautics, already located in the Smithsonian Building. For several years Mr. Paul Brockett, assistant librarian of the Institution, has been collecting publications, especially periodicals, relating to aeronautics, and these have been added to the volumes and pamphlets brought together by the late secretary, making a very good reference library now available.

It is an odd but happy circumstance that the Government is now, although indirectly, to promote aviation and the study of aeronautics after ten years of inactivity, and that the branch of it to carry on the work is that whose secretary previously undertook the now historical experiments which, after incurring an unfortunate accident, and receiving much public ridicule, were terminated by the Government, which thereby lost an opportunity for international leadership in aeronautics. It is hoped that now the United States will pursue what investigations and experiments are undertaken by the committee, in the Langley laboratory or elsewhere, and in no event relax its interest or neglect opportunities for the national development of aeronautics.

"The Mysterious Problem"

By Clarence T. Hubbard

THE following combination of two old principles makes a pleasing conjuring experiment for parlor presentation. It is very simple in operation, requires no skill to speak of, yet with appropriate "patter" it makes an astonishing effect. The method found most satisfactory is as follows: The performer displays a large sheet of white paper, calling attention to the fact that it contains no writing or marking of any kind. This is suspended from a frame or rested against an easel in full view of the spectators. Then the entertainer addresses the audience and requests them to think of a number. This being done, they are asked to multiply the number thought of by 2. The next step in the process is to add 6 and to then divide the result thus obtained by 2. Next, direct them to subtract the number originally thought of and to add 4 to the final result. The conjurer then applies a match to the paper, which is seen to burn up with the exception of a strip that resembles the figure 7 very distinctly. Seven proves to be the answer to everybody's problem regardless of the fact that each person thought of a different number to begin with. To obtain the effect with the paper the reader must add a few drops of nitric acid to a sufficient quantity of asbestos paint and with a brush outline the figure on the paper and allow it to dry. This, of course, must be done prior to giving the exhibition. Seven will always be the answer if the above formula is employed. A little talk relative to the peculiar properties of the figure seven would add to the amusement of the trick. Try it.

The Current Supplement

IN this week's issue of our SUPPLEMENT Sidney Low discusses the question "Is Our Civilization Dying?" It is difficult to fix beyond doubt the causes of the decline of great empires. Were they physiological? Or was moral corruption the principal cause? These and many other questions Mr. Low seeks to answer.—A tragic balloon accident, presenting very unusual features, recently occurred near Paris. An illustrated description of the facts known is reproduced from French sources.—Chester L. Lucas describes the manufacture of steel type, such as is used, for example, for stamping metal articles.—Prof. Hilbert endeavors to gage the length of geological epochs on the basis of radioactive phenomena.—Prof. Charles L. Parsons gives a comprehensive review of the present situation as regards occurrence and extraction of uranium and radium ores in this country and abroad.—E. V. Heward, in an article entitled "Glimpses of the Moon," discusses some of the most interesting problems which the nearest of all heavenly bodies presents to us. Are the volcanoes on the moon still active? Is there vegetation on our satellite? These are questions which some astronomers are disposed to answer with yes.—D. A. Lyon writes on the use of the electric furnace in the production of iron from the ore.—An article on "Ugly Fishes" presents to the readers some remarkable vagaries of nature in the fish world.—The article by A. J. Lotka on "Evolution From the Standpoint of Physics" is concluded in this issue.

What is the Minimum Lung Capacity?

USING what is known as the pneumo-thorax method. Bernard and Le Play showed in France that the minimum lung capacity which is compatible with life may be estimated at one sixth of the normal capacity. J. Courmont, in his experiments which he has been carrying on for a number of years, reaches similar conclusions by the use of a different method. He removes portions of the lungs of animals such as rabbits or dogs, and finds that these animals are able to live for several months after the ablation of three quarters of their lungs. In addition to this, he notices that the entire removal of one of the lungs is followed by a slight compensating hypertrophy of the remaining lung, together with dilatation of the right side of the heart.

A Project to Raise Decatur's Frigate the "Philadelphia"

By H. C. Plummer

AFTER almost one hundred and ten years' rest in the sands at the bottom of the Libian Sea, the gallant United States frigate "Philadelphia," once the "terror of the sea," will be raised and brought to America, if legislation soon to be introduced in Congress by Representative J. Hampton Moore of Pennsylvania is approved. The wreck of the old Yankee man-o'-war lies directly in the path of a system of harbor improvements at Tripoli that are contemplated by the Italian Government. These comprise the building of railway termini, warehouses and docks and the erection of permanent steel hangars for the dirigibles and aeroplanes used by the Italian army forces for reaching the wild desert interior of Fezzan, which is exceedingly difficult of access by land.

The movement to bring to the surface and to transport across seas to this country the "Philadelphia," which was started by an American war correspondent, Harold Sherwood Spencer, after the close of the late Italo-Turkish conflict, has made a distinct appeal to the patriotic and romantic sentiments of the Italian people. "A glorious page from American history rises from the bottom of the Libian sea" is the headline of an editorial upon the subject which recently appeared in *La Nuova Italia* (*The New Italy*), the daily newspaper of Tripoli and organ of the military administration of Tripolitania. The article reviews in eloquent terms the gallantry of Lieut. Stephen Decatur, who, more than a century ago, boarded the captured "Philadelphia" with sixty men and officers and, "within half gunshot of the Banshaw's castle," succeeded in burning and sinking the frigate and in effecting the escape of himself and his company of three-score to the ketch "Intrepid." He had been assigned to his perilous task by Commodore Edward Preble, commanding the United States ship "Constitution," at anchor in the harbor of Syracuse, on the southern coast of Sicily, opposite to Tripoli.

Through the efforts of the American consul-general at Tripoli, John Q. Wood, permission for the raising of the wreck has been granted by Governor-General Ragni, who personally aided a technical investigation lately conducted at the scene by Lieut. Richard Drace White, naval *attaché* of the American embassy at Rome. This investigation was further assisted by William S. Riley, an Englishman who has been a resident of Tripoli for twenty-five years and who has manifested a lively interest in the recovery of the one time defender of American commerce on the high seas.

An appropriation of $15,000 is sought for the bringing to the surface of the "Philadelphia" and her conveyance through the Mediterranean and across the Atlantic to this country. The wreck lies in about 15 feet of water directly off the Spanish fort at Tripoli and near a breakwater and lighthouse constructed by the Italian government as one of the earliest improvements of the Barbary port wrested from Ottoman dominion.

Divers who were employed by Lieut. White reported the whole wreck to be imbedded in sand in the form of a mound, which slopes off in all directions. They sawed off portions and found the planking covered with copper in a state of partial decomposition and also found the remains of nails so corroded that they are nothing but hardened rust.

In his report to the Director of Naval Intelligence at Washington, the naval *attaché* stated:

"When Mr. Spencer suggested raising her, he was of the opinion that the ship rested on an approximately even keel and did not extend deep into the sand, and his idea was that she could be scooped out and lifted with shears and got on shore intact. . . . It appears that she lies on her side (thought to be starboard, though this is uncertain), her keel in a line approximately northeast and southwest. She is entirely covered by sand, except for a portion approximately 35 feet in length on the above-mentioned bearing and 15 feet in width, in which space portions are visible in places projecting above the sand bottom in some cases as much as 1½ feet.

"There are three or four projections visible, which appear to be ribs or frames of the hull. These appear to curve upward, which leads me to believe that they are situated near the bow or the stern. This is, however, only a surmise, as the curvature may only be apparent. There are several planks which extend in a northeasterly direction and end abruptly. Beyond their end is a rectangular piece lying at right angles to the lengthwise direction of the planks. . . .

"The divers who made the examination; the engineer in charge of the divers, Mr. Spencer, Mr. Riley, the American consul, Mr. John Q. Wood, and I are agreed in the opinion that the part visible is the remains of the ribs and skin of the ship. The planking which ends so abruptly we believe to have sprung loose, or pried loose, from the frames, and to have straightened out more or less. We conclude that the ship sunk on the original bottom of the harbor, which slopes away abruptly to the northeast, with one end much lower than the other, and that the sand which now covers her has sifted in, making the harbor at this point much shallower than it was at the time she sank.

"Granting that the ship was 40 feet in beam and 200 feet long, she must extend in the sand to a depth of approximately 40 feet, and for a length of approximately 200 feet. . . .

"It is believed that the best way to attempt to raise her is to dredge around her and inside her as much as practicable and then raise her with floats and chains, if practicable, intact; otherwise, in sections cut adrift before being lifted.

"In this connection the lack of facilities available at Tripoli for work of this character has been considered. There is a small floating crane of 75 (I am told) tons capacity. There are some small lighters; there are some small cranes on shore. That is practically all."

The Ditta Amalgià, an Italian engineering firm which has the contract for the commission of the improvements planned by the royal government, provided Lieut. White an estimate of $12,000 for the raising of the "Philadelphia" and the placing of her on the beach at Tripoli.

The American *attaché* thus concludes his report:

"The project is to raise her intact, but this may become impracticable, in which case it would be necessary to raise her piece by piece. Their estimate is based on the assumption that there would be 4,000 cubic meters to excavate, at a cost of $2.50 per cubic meter, and that the cost of raising her and putting her ashore would be $2,000. They also estimate that they could raise a section of 45 feet length along the part now projecting above the water for $5,000. And I am of the opinion that for $2,000 that part projecting above the bottom and a considerable portion adjacent thereto could be raised.

"In addition to the cost above enumerated there would be the cost of conveying the material recovered to the United States."

From the date of her launching at Philadelphia, November 28th, 1799, until the hour of her ignominious capture by the Tripolitans, October 31st, 1803, the frigate which it is now sought to recover and to preserve to posterity, maintained a glorious record for the Stars and Stripes and the young navy of the American republic. She was the flagship of a squadron of thirteen vessels under command of Capt. Stephen Decatur, senior, on a cruise to the West Indies in 1800, in which she effected the capture of five vessels from the French.

She sailed from Philadelphia on her third and last cruise, commanded by Capt. William Bainbridge, July 28th, 1803, and on August 26th, 1803, shortly after she had reached the Mediterranean, she captured, near Cape de Gatt, the Tripolitan ship "Meshboka," or "Murboka," and recaptured from her the American brig "Cecilia" of Boston.

The American Road Congress

THE American Road Congress will hold its third annual meeting at Detroit during the week of September 29th. This decision was reached by the joint committee of which Logan Waller Page, director of the United States Office of Public Roads, is chairman, after a spirited contest which finally narrowed down to the cities of St. Louis, Denver, Minneapolis, and Detroit. The congress is the great annual assemblage of the good roads organizations throughout the United States, and is held under the auspices of the American Highway Association, the American Automobile Association and the National Association of Road Machinery and Material Manufacturers, the latter organization being concerned primarily with the exposition of machinery and materials held in conjunction with the congress.

As there are between thirty and forty State and interstate organizations identified with the American Highway Association in addition to its 1,800 regular members, the big meeting will be thoroughly representative in character.

Arrangements have just been made to hold the annual meeting of the Michigan State Good Roads Association which has 15,000 members, the newly organized Michigan Trunk Line Association, and the Ontario Good Roads Association, in conjunction with the congress. The combined attendance of these various road organizations will be well over 5,000 and will certainly set a new record far in advance of attendance figures at any previous good roads meeting in the United States.

The foremost engineers and contractors will join with distinguished laymen in making the programme complete and effective. The sessions will be arranged as heretofore so as to specialize on construction, maintenance, legislation, administration, economics, etc. It has been decided to have a special session for the benefit of contractors, and in order to make this session of practical value to the contractor, a committee composed of some of the best informed men on contract work in this country will have full charge of preparing the programme and conducting the session.

The exposition will be held on the ground floor of the Wayne Gardens immediately under the large hall in which the sessions of the congress will be held, and in order to meet the requirements of the companies which manufacture heavy road building machinery, a large vacant lot and an adjoining street will be transformed into exhibit space by the erection of a large tent in which heavy machinery may be exhibited and demonstrated. As heretofore, the remarkable Government exhibit of road models will be a feature of the exposition together with the various State exhibits which will be shown in much larger number than at the congress held in Atlantic City in 1912.

The officers of the congress are Logan Waller Page, director of the United States Office of Public Roads, president; Lee McClung, former Treasurer of the United States, treasurer; J. E. Pennypacker, secretary of the American Highway Association, secretary; and Charles P. Light, former State Highway Commissioner of West Virginia, assistant to the president. The headquarters of the congress are in the Colorado Building, Washington, D. C.

Exhibition of Improved Talking Pictures and Moving Pictures in Natural Colors

ON the 5th instant there was given in the Thirty-ninth Street Theater in New York city, by arrangement with Mr. Frederick C. Beach of this journal, two demonstration performances of talking pictures and moving pictures in natural colors as perfected by M. Leon Gaumont of Paris, France.

As early as November 17th, 1902, M. Gaumont gave a demonstration before the French Photographic Society of talking moving pictures, in which there was complete synchronism between the phonograph and the cinematograph. These records were made simultaneously.

Besides talking pictures, M. Gaumont has been working for some time at the problem of producing moving pictures in natural colors. About a year ago he succeeded in accomplishing this in a simple and direct manner.

The method of obtaining these pictures is that used in the well-known three color process, viz., the making of three separate negatives through transparent color filters of the three primary colors and the projecting of the corresponding positives through their three respective color filters in superposition and accurate register upon the screen. The rate of projection of the pictures is as usual sixteen per second, they being arranged in groups of three on the film, which is moved far enough each time to bring another group before the triple lenses.

The exhibition was opened with chronochrome pictures of flowers in vases on a revolving table, followed by outdoor scenes. The first picture showed the flowers in black and white, but with a remarkable stereoscopic effect, the result of there being three distinct pictures superposed on the screen instead of but one. The second picture showed the same flowers in all their natural beauty, while the views that followed, depicting farm scenes in the south of France and glimpses along the Riviera, were entrancing in their naturalness.

A photo play taken under artificial light was shown, in which the colors of the costumes and decorations were perfectly rendered. The facial expression of the actors was reproduced with a naturalness and softness that was wonderfully lifelike, and there was nothing lacking in detail.

There followed beautiful studies in nature of mounted specimens of butterflies in which the varying sheen on the wings when viewed from different angles was extremely beautiful. Words can hardly express, too, the magnificent nacreous luster on some specimens of sea shells that were shown.

The talking picture exhibition demonstrated the remarkable effectiveness of the electrical synchronism between the picture film and phonograph, the loudness of the sound of which is intensified by means of compressed air on the principle employed in the Parsons auxetophone.

A talking motion picture play of twenty minutes duration was produced by a series of records rapidly changed from one to another, by a special device, until the close of the play. An amusing subject was a rooster standing on a pedestal, flapping its wings and crowing very naturally and vigorously.

Another example was a lion tamer putting his lions through their tricks, which resulted in much naturalistic roaring by several of the beasts.

Piping Hydrogen for Airships.—A pipe-line for hydrogen is in successful operation between the electro-chemical works "Griesheim-Elektron" and the airship hangar in Frankfort-on-Main. The line is 4½ kilometers long and to avoid the danger of leaking from non-tight joints it is welded autogenously throughout most of its length, the pipe being joined by unions only at long intervals. One thousand cubic meters of gas per diem can easily be supplied, which requires a pressure of about 1,000 millimeters (water column). The pipe ends at the plant in a gas-tank of 6,000 cubic meters capacity. The hydrogen passes thence into subterranean pipes in the hall (Halle) in whose cement floor are 18 shafts provided with gas-cocks which are connected by tubes with the separate compartments or cells of the airship. The hydrogen is produced as a by-product in the electro-chemical manufacture of caustic soda and chlorine from sodium chloride in such large quantities that much of it still goes to waste in spite of the greatly increased demand for hydrogen. This plant produces daily from 18,000 to 20,000 cubic meters of hydrogen, a sufficient quantity to entirely fill a Zeppelin.

Bacteriology and Your Health

Serums and Vaccines in the Diagnosis, Treatment and Prevention of Disease

By Dr. Charles F. Bolduan

IT has long been known that certain infectious diseases occur naturally only among some of the lower animals and do not attack man; while, conversely, others appear to attack only man. Moreover, we are all familiar with the fact that persons who have once had, say measles, or scarlet fever, or small-pox, are thereafter safe from a second attack, or as it is usually expressed, are "immune." Since little was known as to the real nature of the infectious diseases until about thirty years ago, it is easy to see how the discoveries of bacteriology in the eighties opened up a wonderful field for the medical investigator; and although most of the fundamental researches concerning the nature of immunity against infectious diseases date back hardly more than fifteen to twenty years, much light has already been shed on many obscure problems of medicine, and the promise of further substantial benefits to mankind is held out. True, the work of Jenner in the end of the eighteenth century taught us the value of vaccination against small-pox; and Pasteur in 1881 demonstrated his method of successfully protecting animals against anthrax by injecting them with living, weakened anthrax bacilli. Neither of these discoveries, however, important as they were, gave any real insight into the nature of immunity. The subject was really illuminated when Behring, in 1890, announced his discovery of diphtheria antitoxin.

But let us go back, for a moment, to the time of Pasteur, say to the late seventies of the last century. It was well known that individuals who had had one attack of a particular disease were thereafter practically safe from a second attack; in other words, they were *immune*. This form of immunity is well illustrated in scarlet fever, measles, small-pox, yellow fever. Often it lasts throughout the lifetime of the individual, though there are exceptions. In studying this acquired immunity, Pasteur conceived the idea of artificially producing an attack of a given infection in order to protect the individual against another attack. He realized that it would be necessary so to control matters that the original attack should run a very mild course and not endanger the life of the individual. After considerable experimentation, he found that this could be accomplished by artificially weakening the bacteria with which the original attack was produced. Subsequently Salmon and Smith, two American scientists, showed that it was not necessary to produce even a mild attack of the disease by the injection of living bacteria, but that the injection of dead bacteria would produce an immunity against that particular bacterial infection. This form of immunity, whether caused by a previous natural attack of the disease, or artificially by the inoculation of bacteria, is always *strictly specific*, that is, the protection extends only to the particular disease which has previously occurred or whose germs have previously been injected. An attack of scarlet fever protects only against scarlet fever, but not against measles; inoculating an individual with typhoid bacilli protects him only against typhoid fever, but not against dysentery, or plague, or cholera.

When Behring announced his discovery of diphtheria antitoxin, a host of laboratory workers at once took up the study of the blood serum as affected by bacterial injections. At their head was Paul Ehrlich, and it is largely to his extraordinary genius that we owe our present knowledge of this intricate subject. As a result of these investigations it was found that in response to the invasion by pathogenic bacteria, the body manufactures certain specific substances designed to destroy the invaders or to neutralize their poisonous products. These antagonistic substances are spoken of as antibodies. The important antibodies thus far known are (1) antitoxins, (2) bacteriolysins, (3) agglutinins, (4) opsonins, (5) precipitins, and (6) antiferments.

When an animal is injected with gradually increasing doses of diphtheria poison, it withstands doses of the poison after a time which would suffice to kill hundreds of animals not so treated. This was done by Behring, in 1890, who found that the blood serum of the treated animals contained something which neutralized the diphtheria poison and rendered it harmless. What could be more natural than to see whether this blood serum could be used to treat other animals previously injected with diphtheria poison? Behring found that the serum thus used was able to save the animals from death. The action of the substance in the serum which counteracted the effect of the poison proved to be exactly like that of an alkali on an acid, i. e., it neutralized the poison. It was therefore called an *antitoxin*. The antitoxic serum does not differ in appearance from that of a normal, untreated animal, and even when tested chemically, but little difference can be discovered between the two. In order, therefore, to recognize the presence of this antitoxin in the serum, and especially in order to measure its amount, we must test it in animals, and see how small a quantity of antitoxic serum will save an animal after injection with a certain amount of diphtheria poison. It may interest the reader to know that sometimes as little as 1/5,000 cubic centimeter suffices to save from death a guinea pig which has received ten fatal doses of diphtheria poison.

In the manufacture of diphtheria antitoxin sheep were first used as the source of the serum, but at the present time horses are almost entirely employed. They are easily managed, produce high-grade antitoxic serum, and yield enormous quantities of serum if properly bled. The animals are injected subcutaneously, receiving at the first injection an amount of diphtheria poison sufficient to kill about five hundred guinea pigs. Using gradually larger and still larger doses, the injections of poison are repeated weekly or oftener for about three months, at which time the horse will be found to have manufactured considerable antitoxin. In order to obtain the antitoxin, the animal is bled by inserting a sterile, hollow needle into the jugular vein, about six or seven quarts of blood being collected at one bleeding. The vials, the stoppers, as indeed all the utensils used for holding the serum, must be absolutely sterile, and every possible precaution must be taken to avoid contamination of the serum. The blood having been carefully collected in sterile flasks is allowed to clot, which causes the clear, straw-colored serum to separate. This serum is drawn off and constitutes the antitoxin as it is used by physicians.

The success attending the use of diphtheria antitoxin is now so well recognized that I need not go into that phase of the subject. Suffice it to say that prior to the introduction of antitoxin the mortality from diphtheria was about five times what it now is. This is well shown in the chart on this page.

Unfortunately it has been found impossible, except in a few instances, to produce antitoxins, because very few bacteria secrete toxins like the diphtheria bacillus. Careful study of the blood serum has shown, however, that even though no antitoxin is produced, the injection of bacteria is often followed by the formation, by the injected animal body, of substances which kill and dissolve the invading bacteria. Thus, if an animal is injected with typhoid bacilli, the serum will kill enormous numbers of typhoid bacilli after a time, even in very small doses; tested against cholera bacilli or against any other bacteria, its destructive effect is merely that of normal serum from an untreated animal. When the action of the

In order to obtain the antitoxin of the inoculated animal a sterile, hollow needle is inserted into the jugular vein. About six or seven quarts of blood are thus collected. The serum is drawn off and constitutes the antitoxin used by the physician.

Much interest has been aroused during the past few years in studies in serum treatment, and much has been written about the marvelous success achieved by our army surgeons in preventing typhoid fever during the maneuvers by the use of typhoid vaccines. More recently the newspapers have been filled with accounts of Friedmann's alleged cure for tuberculosis by means of living tubercle bacilli. In order to give our readers an intelligent idea of the principles underlying these modern therapeutic methods, we have asked Dr. Charles F. Bolduan, a well-known authority in this field, to prepare for us a clear account of this highly technical subject. For years on the scientific staff of the bacteriological research laboratory of the New York city health department, Dr. Bolduan has become widely known by numerous papers in scientific journals, and as the author of several text-books dealing with the subject here discussed.—EDITOR.

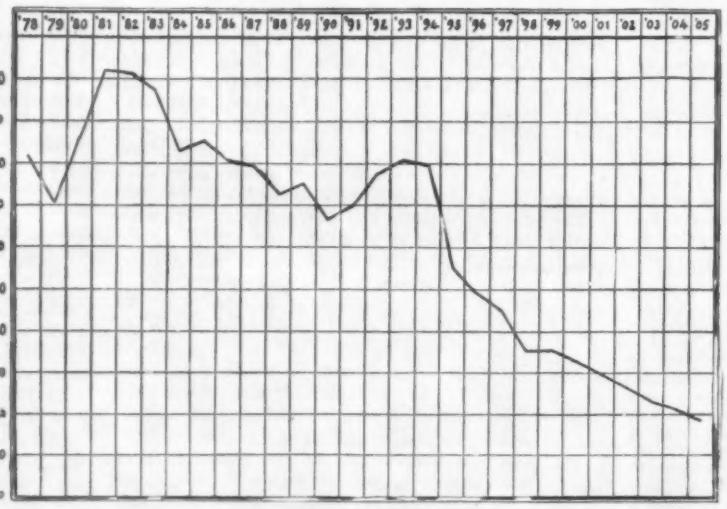


Chart showing the result of anti-toxin treatment in diphtheria.

The curve represents the death rate from diphtheria per 100,000 of population in nineteen large cities of the world. Note the rapid fall in the year 1895, following at once the introduction of anti-toxin treatment in that year.

serum on the bacteria is studied under the microscope it is seen that the bacteria are actually dissolved. Hence such a serum is spoken of as a *bacteriolysin*, which means bacteria-dissolving. Since the bacteria are killed by this action, we also speak of the serum as being *bactericidal*, which means bacteria-killing.

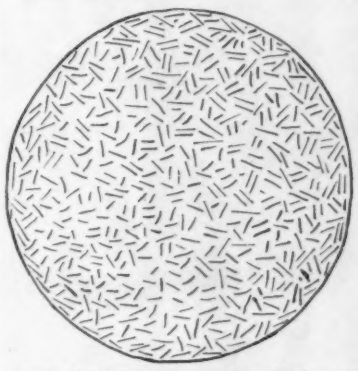
It has been found that this action of the serum may be developed against other cells than bacteria. When red blood cells are used, the serum acquires dissolving properties for these; and here again, the action is strictly specific, so that when blood cells from a chicken are injected into another animal, the serum of the injected animal acquires increased solvent powers only for chicken blood cells, but not for blood cells of other animals.

Investigation showed that the mode of action of these dissolving sera was somewhat complex and required the joint action of two different constituents. One of the constituents decomposes very easily, so that a serum which has stood several days may be found to have entirely lost its solvent power. This unstable constituent, however, is not peculiar to the serum of the treated animal, but is found in all fresh sera, even in those from normal, untreated animals. Hence it is possible to restore the solvent power to old, specific dissolving sera by the addition of a little fresh serum from a normal animal. This unstable constituent is spoken of as "complement." When using specific bacteriolytic sera therapeutically, we do not attempt to secure freshly-drawn serum, but rely on the complement present in the blood of every individual to supply the unstable constituent. For reasons largely still unknown, the use of many of these specific bacteriolytic sera for the cure of infectious diseases has been quite unsuccessful, and many difficulties still remain to be overcome. In some instances the fault seems to lie, not with the serum, but with the mode of its application. Thus, in the case of the serum for epidemic cerebro-spinal meningitis, the results first obtained were most discouraging; at that time the serum was given by means of subcutaneous injections. For some years past, however, the results have been uniformly good, the mortality being less than half that in cases treated without the serum. The serum is the same as before, but now it is always introduced directly into the spinal canal, where it can directly attack the invading bacteria.

The researches of Metchnikoff showed that the white blood cells, or leucocytes as they are called, lay hold of and digest invading bacteria, and thus constitute an important means of defense against bacterial invasion. Subsequently, Sir Almroth Wright, a distinguished English physician, showed that certain substances present in the blood serum have the power of increasing the appetite, as it were, of the leucocytes, and, furthermore, that the amount of these substances can be increased by properly administered injections of the same bacteria it was desired to destroy. These substances in the blood serum he called *opsonins*. Wright devised an ingenious technique for measuring the opsonic power of the serum, using fresh human leucocytes, a suspension of the test bacteria, and serum from the patient. After allowing these to remain in contact for a given time he made microscopic preparations and noted the result. He compared this with a similar preparation made from the same leucocytes, the same bacterial suspension, but with serum from a normal individual instead of from the patient. He showed that before commencing treatment the patient's opsonic power was low, as evidenced by the small proportion of bacteria taken up by the leucocytes in comparison to those in the specimen with serum from the normal individual. With successful treatment with bacterial vaccines (see below), he caused the opsonic power to rise, as shown by the increasing proportion of bacteria taken up by the leucocytes, and with the cure of the infection he caused the opsonic power of the patient's serum to be even greater than that of the normal individual. The measurements are always relative, the ratio between the average number of cells in the two sets of preparations constituting the *opsonic index*. This will be clear by studying the annexed diagrams.

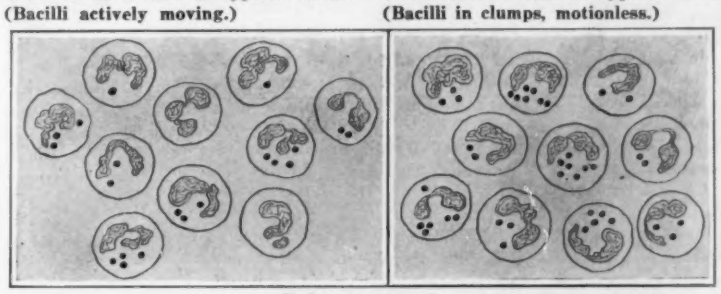
Collecting vaccine from a calf.

The calves which are used in the preparation of the virus are first washed, the long hair is clipped, and the skin is cleaned with an antiseptic solution, after which the surface to be operated upon is shaved. The animals are then conveyed to the operating room, where they are vaccinated with tested virus under conditions similar to those existing in the operating rooms of modern hospitals, after which they are transferred to the propagating stable and kept as clean as possible. In about six days the virus is removed as shown in the picture, and ground up into the pulp used to vaccinate human beings against small-pox.



Typhoid bacilli before the addition of serum from a case of typhoid fever. (Bacilli actively moving.)

Typhoid bacilli after the addition of serum from a case of typhoid fever. (Bacilli in clumps, motionless.)

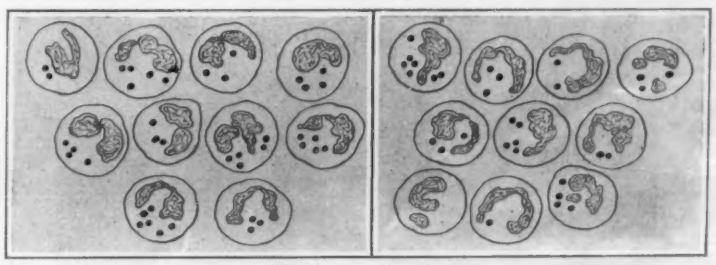


Before treatment.

THE PATIENT'S SERUM
Average number of bacteria per leucocyte = 2

SERUM FROM A NORMAL INDIVIDUAL
Average number of bacteria per leucocyte = 4

$$\text{Opsonic Index} = \frac{2}{4} = 0.5$$

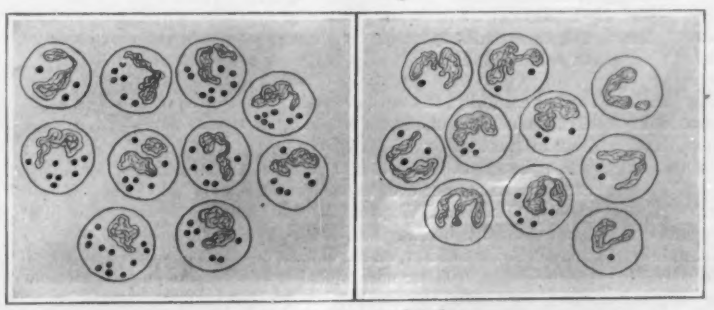


During treatment.

THE PATIENT'S SERUM
Average number of bacteria per leucocyte = 4

SERUM FROM A NORMAL INDIVIDUAL
Average number of bacteria per leucocyte = 3

$$\text{Opsonic Index} = \frac{4}{3} = 1.33$$



Treatment completed.

THE PATIENT'S SERUM
Average number of bacteria per leucocyte = 7

SERUM FROM A NORMAL INDIVIDUAL
Average number of bacteria per leucocyte = 2

$$\text{Opsonic Index} = \frac{7}{2} = 3.5$$

But this does not yet exhaust the list of antibodies produced by the animal body in response to injections of bacteria. When the serum of an animal which has been repeatedly injected with bacteria is brought into contact with some of these bacteria, careful observation under the microscope reveals an interesting series of changes. Thus, if typhoid bacilli are mixed with the serum of a rabbit which has previously been treated with injections of typhoid bacilli, or if the bacilli are mixed with serum from a patient suffering from typhoid fever, one notices first that the typhoid bacilli become sluggish in their movements. This is followed by the gradual collection of the bacilli into clumps. At the end of an hour or two, in place of countless bacilli moving quickly through the field, one sees merely several groups of absolutely immobile bacilli. This phenomenon is spoken of as agglutination, and the substance in the serum which brings it about as agglutinin. Like the bacteriolysins, the antitoxins, and the opsonins, the agglutinins are strictly specific, i. e., serum from an animal previously injected with typhoid bacilli will clump only typhoid bacilli; one from an animal injected with cholera bacilli will clump only cholera bacilli, etc. The simplicity of this reaction, as well as its specificity, has made it an important adjunct in the diagnosis of typhoid fever and other infections. The microscopic appearance of the bacilli before and after clumping is shown in the annexed drawings.

It must not be thought that the list of anti-substances above enumerated is at all complete, or, what is more, that invasion of the body by bacteria produces changes only in the blood. Not only are still other antibodies produced in the blood, but investigation has shown that other tissues of the animal body likewise undergo subtle changes in response to bacterial invasion. This fact is made use of in the diagnosis of tuberculous infection by means of the skin test. A small quantity of tuberculin (extract of tubercle bacilli) rubbed into a tiny abrasion in the skin of a tuberculous individual causes a typical inflammatory reaction at the point of application, while in uninfected individuals no such reaction results. The test is sometimes performed by dropping a weak solution of tuberculin into the eyes, causing a marked congestion (pink eye) in tuberculous individuals.

Because of the non-success attending the use of the antibacterial sera, previously discussed, attention has been turned to treatment of bacterial infections by means of *active immunization*. This consists usually in injecting the patient with small doses of dead bacteria, thus causing the production, on his part, of the various antibodies already described, and so bringing about a condition of immunity. The injected dead bacteria are spoken of as a "bacterial vaccine." This method may be said to date from the researches of Pasteur concerning protective inoculation of animals against anthrax. It will be remembered that Salmon and Smith showed that even dead bacteria could be used for protective inoculation. The protective inoculations against typhoid fever, as practised by the United States Army, consist of dead typhoid bacilli. Largely through the efforts of Wright, such inoculations are also extensively used to cure an infection already in progress, and in a limited number of infections, strikingly successful results have been obtained. In a number of other infections, e. g., typhoid fever, the bacterial vaccines have been remarkably successful in preventing the disease, but practically without value in the treatment of cases already established. Even when used merely as a pre-

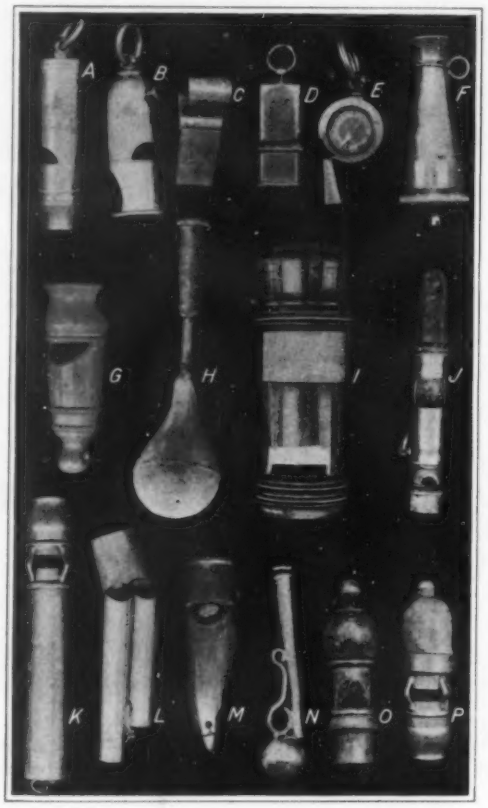
(Continued on page 549.)

Shape and Sound in Whistles

By Gustave Michaud, Costa Rica State College

IF it be considered that whistles are among the oldest musical instruments the fact that very little is still known about the origin of the sound which they emit seems strange. One and the same explanation was found not long ago in nearly all elementary text-books on acoustics. Condensations are produced, we were told, at irregular intervals, by the collision of air against the cutting edge placed on its path. These oblige the current to escape at times through the opening placed above the edges. Dilatations follow the condensations and the tube reinforces such vibrations as its length permits. Like some streams of water the explanation is clear only because of its being shallow and the thoughtful reader tries in vain to find out the cause of the transformation of a continuous into an alternating motion. The discovery in organ pipes of the air whirlwinds called Looten's cyclones, which probably play a very important part in ordinary phonation, has still further complicated the problem and neither Hensen's theory of the pendulary motion of air, nor the works of his opponents, Friedrich, Kreis and Wachsmuth, have so far thrown much light upon it.

It is none the less interesting to note the change undergone in recent years by the classical whistles G, O and M, shown on the accompanying figure. Several minor improvements are mere applications of some well-known law of acoustics. Others are evidently the result of empirical research. Thus it is probable that whistles *C*, *E* and *N* owe their power to their shape, which highly favors the formation of Looten's cyclones, but how and why is not thoroughly understood. Whistle *C* is but a freaky imitation of *E*. It remains silent in the hands of the unaware person who does not use his fingers as lateral walls for the uncomplete cylindrical box. Whistles *K* and *P* embody an attempt to increase the volume of sound through an extension of the cutting edge around the whole instrument. Both are noisy calls but require powerful lungs. In the scientific instrument called Galton's whistle (*H*) length of pipe may be made to vary through the motion of the end screw. Pitch varies accordingly and the whistle is used to ascertain the individual upper limit of audible sounds, as it can produce those which cannot be heard, that is which result in over 40,000 vibrations per second. Pitch of whistles *P* and *I* can be made to vary, as in Galton's whistle, through changes in the length of pipe. In the American model, *P*, this is accomplished by merely pressing the rubber end of the whistle. The French whistle, *I*, is provided with a sliding end. In whistle *B* but two different sounds are produced, through a change from open to closed pipe; on top of the whistle is an opening which can be closed with the finger. Two sounds are also produced by whistles *A* and *L*, but they are simultaneous and, according to the maker's whim, give either a harmonious whole or a rough sound with perceptible beats. In *L* the two tubes are side by side; in *A* they are superposed. *D* has been considerably flattened in the plane containing the cutting edge, not, probably, to take advantage of Savart's law, but merely to allow the easy carrying of the whistle in a vest pocket. So far as the origin of sound is concerned *F* cannot be called a whistle, although it is used as such and gives a powerful whistling sound. It is probably the smallest siren ever made for practical purposes. It shows again that the characteristics of the whistling sound lie in pitch only and not in quality; moderate and steady blowing gives a sound that cannot be distinguished from that of other whistles. With this little siren as with Galton's whistle, the upper limit of perceptible sounds can be reached. *J* is a hybrid instrument, whistle at one end, trumpet call at the other. The same can be said of *E*, which carries a compass on one side.



Classical, hybrid, scientific, practical and freak whistles.

Optical Phenomena Seen from Balloons

By C. Fitzhugh Talman

BESIDES the optical phenomena of the atmosphere which ordinary mortals may enjoy from time to time—rainbows, coronas, halos, the colors of sunrise and sunset, mirage, etc.—there are two interesting spectacles of this class which require, for their observation, an elevated point of view, and which are most favorably seen from balloons. These phenomena, especially when observed for the first time, usually make a profound impression upon the mind of the aeronaut, and have therefore frequently been described in narratives of balloon voyages.

The commoner of these is the Brocken specter. The reader is probably familiar with descriptions of this weird phenomenon as seen from the tops of mountains—not only the witch-haunted Brocken, but many other mountains the world over. The mountaineer sees his shadow cast upon a nearby bank of fog or cloud—apparently of colossal dimensions, though this is an illusion, due to an overestimate of the distance of the shadow from the observer. Surrounding the shadow there is often seen a circle of prismatic colors—technically called a *glory*—the center of which is that point in the shadow which corresponds with the position of the observer's eye. Hence, if the shadow is very near only the head appears circled with colored light, but if more distant the whole shadow is inclosed in the glory. This is one of several points in connection with the Brocken specter that are not made clear in the ordinary descriptions of it; while the usual pictures (drawings) are even worse, for they give the impression that the shadow cast by a person, whom we will call *A*, with its attendant glory, may be seen by another person, *B*, from almost any distance or angle of view. The truth is, that *A*'s specter and its rings can be seen only by himself, or by another standing very close to him. This is one illustration of the fact that drawings of nearly all the optical phenomena of the atmosphere are more often than not decidedly inaccurate and misleading, and points to the superiority, in certain respects, of the photograph—in which the artist's imagination and misconceptions can play no part. On the other hand, the photograph is usually an incomplete picture of the phenomenon, owing to the fact that the photographic plate is unequally sensitive to light of different colors, and may also fail to register phenomena of feeble luminosity, as the time of exposure is often insufficient, on account of the evanescent character of the subjects in question.

Photograph by Dr. A. Wegener.

Fig. 1.—Shadow of a balloon on the clouds, surrounded by rings of colored light.

Photographed from a balloon by Dr. A. Wegener.

Fig. 2.—Pseudhelion, the sun's image seen on a sheet of cloud below the observer.

We present herewith (Fig. 1) the only photograph of the Brocken specter ever taken from a balloon. It was made by Dr. Alfred Wegener, of the University of Marburg, Germany, on May 8th, 1910. Here the "specter" consists of the shadow, on the clouds, of the balloon and its basket; the latter surrounded by a brilliant glory. The glory showed the usual series of colors, ranging from blue inside to red outside, and this series was twice repeated. In order to identify the colors on the photographic plate, Dr. Wegener photographed with a similar plate the spectrum of an arc light, and observed the intensity of the image produced by its different parts. It was thus found that violet made no impression on the plate; that red and blue were very weak; that yellow was very strong, etc. From the relative intensity of the different parts of the glory, as seen in his photograph, he was able to reconstruct its colors with considerable accuracy, and to measure the angular width of the zone covered by each. The result was extremely interesting, as it showed some marked divergences from the theoretical dimensions of these rings as given in standard works on optics. The moral of this experiment is that scientific aeronauts should henceforth make every effort to secure good photographs of the Brocken specter, and in fact of all the optical phenomena of the atmosphere, in connection with which there are still many unsettled questions.

Fig. 2 is a photograph of the *pseudhelion* or *undersun*, and is also the first of its kind. It was taken by Dr. Wegener on September 4th, 1910. There is very little literature concerning this phenomenon in English—and its name is unknown to the English dictionaries—although it was first described by the aeronauts Barral and Bixio, in connection with their balloon ascent of July 27th, 1850, and is mentioned in the English translation of Flammarion's book "The Atmosphere," published as long ago as 1873. (See p. 144 of that work.) It is a bright image of the sun seen on a sheet of cloud lying below the observer—corresponding in position to the sun's image as reflected in a sheet of water. (It is quite distinct from the rare phenomenon of the *anthelion*, *antisun*, or *countersun*, seen at the same altitude as the sun, but on the opposite side of the sky. This, again, is quite different from the *anthelion* of the dictionaries, for which the name *glory* is now preferred by meteorologists, and which we have referred to above in connection with the Brocken specter. The terminology of atmospheric optics has been so embroiled by unscientific lexicographers that in writing on this subject one is obliged to define nearly every term one uses.)

As to the explanation of the two phenomena described above, the colored rings of the Brocken specter are produced by the diffraction of the sun's light around the tiny drops of water or crystals of ice forming a cloud or fog. The phenomenon is the same as the *corona* so often seen about the moon when shining through fleecy clouds, except that in the glory the light is not only dispersed by diffraction, but subsequently reflected to the eye of the observer. As the Brocken specter is always diametrically opposite the sun, it can rarely be seen from a mountain top except when the sun is low; while from a balloon it may be seen at any altitude of the sun. If the sun is in the zenith the balloonist will see the specter directly beneath him.

The pseudhelion is a member of the numerous halo family. It is an image of the sun reflected from the upper horizontal surface of ice crystals, of which, at low temperatures, clouds are composed. It has occasionally been seen surrounded by a circular or elliptical halo; either the common halo of 22 degrees radius, or an extraordinarily small halo having a radius of only from 1½ to 2 degrees.

Nomenclature of the Polar Regions

SIR CLEMENTS MARKHAM, writing in the *Geographical Journal*, takes exception to the custom of loading the maps of coast-lines in the polar regions with a multiplicity of "lands," belonging to a single geographical unit. Thus, the coast extending west from Ross Sea, in the Antarctic, has no less than thirteen "lands" strung along it; viz., Victoria, Adelie, Sabrina, Wilkes (this name is also applied to the whole coast), North, Totten, Budd, Knox, Termination, Kaiser Wilhelm, Kempe, Enderby, and Coates. Sir Clements does not mention a fourteenth, King George V, just added by the Mawson expedition, which has been exploring the coast in question. The writer also pays his respects to Amundsen (without naming him) in the emphatic statement that the great Antarctic Ice Cap was so named by Capt. Scott, its discoverer, and needs no other designation. It will be recalled that Amundsen named it the King Haakon VII Plateau. To the first of the above-mentioned complaints the reply might be made that, as there are no towns in the polar regions, and as the natural topographic features are in many cases more or less obscure, the so-called "lands" serve as convenient *points de repère*. It is, of course, understood that the term means no more, in this connection, than "region" or "district," and does not imply a natural subdivision of the earth's surface.

The Mathematical Works of the Late Henri Poincaré will shortly be published in Paris under the auspices of the Ministry of Public Instruction and the Academy of Sciences.

Down to Grade in the Culebra Cut

THE accompanying engraving pictures an event that marks an epoch in the history of the Panama Canal. On the afternoon of May 20th, 1913, steam shovel No. 222 from the north and shovel No. 230 from the south, each working on the floor of the canal, met opposite the town of Culebra, completing a channel at the bottom level of the canal the entire length of Culebra Cut. The canal will be completed when this channel has been widened to the required bottom width of 300 feet. To complicate matters several million cubic yards of material is being contributed by the various slides located near the Continental divide, where the cut is deepest. Col. Goethals plans to continue the excavation by steam shovels until October or November, 1913, when the cut will be flooded and the remaining excavation will be taken care of by dredges. Vessels of moderate draft may be permitted to use the canal soon after the flooding of Culebra Cut.

Meeting of the north and south excavation on the bottom level of Culebra.

Clearing a Bridge Wreck With the Oxy-acetylene Torch

INDIANAPOLIS has recently been engaged in removing with fire the wreckage caused by flood waters. Two bridges which crossed White River and Fall Creek, respectively, were badly damaged during the recent flood. Both bridges were of stone and concrete with a framework of heavy steel girders, and when they went down these supports were reduced to a mass of twisted junk, but withstood all efforts to remove them. Finally, the city engineer solved the problem of cutting away the steel wreckage by calling upon a company of that city that makes a well-known automobile acetylene lighting system. In response to the appeal, two oxy-acetylene welding outfits were carried to the bridges and put into operation with cutting torch attachments. The steel girders were quickly severed. The entire work of cutting away the twisted mass of wreckage took only three days. With the cutting torch the girders were first heated and then a stream of pure oxygen was directed against the hot metal. This caused the steel to burn quickly and safely. The average time consumed in cutting a girder was a little over five minutes. The entire apparatus was mounted on a light two-wheeled truck. This feature of portability has made the oxy-acetylene system of welding and cutting very desirable in cases where rapid work is necessary.

Cutting bridge girders with the oxy-acetylene torch.

The Siamese King's Fire Engine

THE King of Siam recently ordered an up-to-date fire engine, but he did not care to have it self-propelled or even provided with tongue or shafts for horse transportation, and so, although a gasoline engine is used to drive the fire pump, the machine has to be hauled to the fire by hand. Such a fire engine may strike us as ridiculous, but it is a sensible apparatus where the machine does not have to be hauled a great distance. In fact, fire engines of this type have been developed in England. One of them is employed by the Great Eastern Railway for protecting its property. It is considered hardly worth while to provide the machine with motor propulsion, as no long trips would ever be demanded of it. The fire engine illustrated herewith, which is to be used for the protection of the Royal Palace at Bangkok, is fitted with a 45 to 50 horsepower, 4-cylinder engine, driving a 2-stage, 300-gallon turbine pump. The whole apparatus weighs about one ton.

A hand-drawn gasoline fire engine for Siam.

Night Golf Putting Course

By T. J. Litle, Jr.

LAST year an article was published in the SCIENTIFIC AMERICAN SUPPLEMENT describing the lighting of the tennis courts of the Woodbury Country Club, Woodbury, N. J. This was probably the first extensive installation of its kind in the world, and it proved so popular that it occurred to the writer that it would be a good scheme to extend this field of artificial illumination to include the lighting of a golf putting course.

Golf putting course lighted by gas arcs.

The course is laid out on a plot of ground 40 by 80 feet and contains nine holes. It must be evident that night playing on such a course is highly desirable. In the first place, only a limited area has to be lighted; in the second place, it makes it possible for business men and others who have not sufficient time during the day at their disposal to practise putting or to play a putting match at night. A night tournament has already been played.

The installation of the lamps is comparatively simple. Two wrought-iron posts are used and two lamps are suspended from the ends of a long cross arm on the top of the posts. Four 5-mantle multi-flex inverted gas arcs are used to light the course. To reduce glare opaline globes were used on the lamps. A fairly uniform distribution of light over the course is desirable, the principal requisite, of course, being to have the nine holes uniformly lighted. This was accomplished by spacing the holes so that they were not more than 10 feet horizontally distant from the lamps. The lamps are equipped with standard distributing reflectors, for it was found that the players not only desired to play on the course itself, but to approach the course with a mashie, and it is possible to do this at a distance of at least 100 feet. The intensity at various holes is approximately 2½ foot-candles. The holes are painted white inside to make them easily visible from any part of the course. To get a good idea of the ample illumination provided, it might be stated that it is considerably higher than that on the floor of an ordinary house at night as it is usually lighted.

The remarkably uniform illumination is shown by the accompanying photograph, which was made by the light of the lamps alone on a dark night with an exposure of 1½ minutes.

The cost of lighting this golf putting course is 7¼ cents per hour for the gas consumed for the entire four lamps, each lamp consuming from 18 to 20 cubic feet of gas per hour, and the cost of gas in Woodbury being 90 cents per thousand cubic feet.

Automobile Traction in Italy

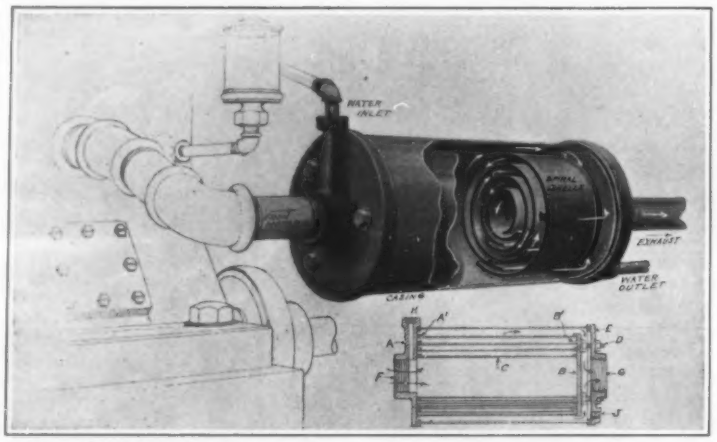
THE Italian government recently gave a striking proof of the favor which automobile traction is meeting with in that country, by deciding to allow subsidies for the establishment of new power wagon or autobus lines in addition to what are now being operated in that country, so that in the near future there will be twenty-four new automobile lines operated. Their object is to give a direct connection between isolated villages and the industrial centers or at least to connect them with the nearest railroad station, and thus awaken progress by the traffic facilities afforded. Several lines which are to be used for places where commerce is becoming developed, are laid out for freight transport by medium-sized power wagons, and this is an interesting example, for generally such lines were designed for passenger and baggage service only. The new power wagon lines will foot up a total distance of 500 miles, and will cover rough country in many cases. Such a ramification of the railroad lines, as it may be termed, will give the greatest service in opening up the country to trade in general. As a result of the rapid progress made in power wagon matters in Italy, the government is taking up the question of good roads and will go into extensive improvements which will require about $1,000,000 for the present stage of the work. As in the case of other European countries, the power wagon lines will penetrate into parts of the country where railroads could not be run owing to the nature of the ground, and thus such localities will no longer be in a disadvantageous position.

Inventions New and Interesting

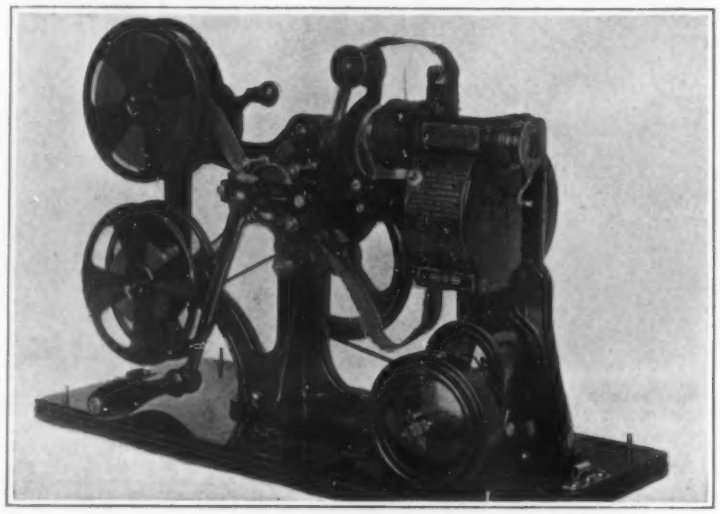
Simple Patent Law; Patent Office News; Notes on Trademarks

A Silencer for Gas Engines

FOLLOWING his well known invention of the silencer for rifles, Mr. Hiram Percy Maxim turned his attention to the noisy exhaust of the gas engine and has evolved a silencer which will muffle or deaden that noise and smooth out the sharp gaseous impulses. The silencer consists of a nested series of spiral shells between which are formed spiral whirl chambers, that the exhaust must traverse. In order to increase the silencing effect these spiral whirl chambers are alternately reversed in direction, so that the gases in passing through them must travel alternately in a right-handed and in a left-handed direction. The whirl chambers are progressively larger, permitting the gases to expand. The arrangement of the spiral shells is shown in the accompanying drawing. They are inclosed in a cylindrical casing. At the inlet end of the silencer, there is an end plate *A* formed with flanges *A'*. Near the outlet end of the silencer is a support *B*, also formed with annular flanges *B'*. The shells *C* are mounted between the plate *A* and support *B*, and are fitted between the flanges. The parts are held in place by means of long bolts *D*, which pass from the plate *A* through the support *B* and the end plate *E*. The bodies of these bolts are flattened where they pass between the spiral shells, so as to offer as little resistance as possible to the flow of gases. They may be seen in section in the enlarged view of the silencer. It will be observed that the spiral shells are formed with lapping ends to provide discharge throats to the succeeding whirl chambers. The shells are so arranged that each discharge throat is angularly advanced in its discharging direction beyond that of the succeeding whirl chamber. In some types of these silencers, certain of the spiral shells, particularly the outer ones, are corrugated, so as to retard the flow of the gases. The arrows indicate the course of the gases through the silencer. They enter at *F*, and pass successively through the whirl chambers, finally issuing into the chamber formed between the outer spiral shell and the wall of the casing. Thence they pass over the end of the support *B*, and out through the exhaust port *G*. In the end plate *A*, a passage *H* is formed, through which cooling water may be admitted to the first whirl chamber of the silencer. In the opposite end plate *E*, there is a port *J* adapted to be fitted with a drip connection for the discharge of the cooling fluid from the silencer.



Nested spiral whirl chambers to silence gas engine exhaust.



A home cinematograph, which generates its own current.

Diagram showing the action of the soft palate in directing a part of the breath in speech through the nasal passages (figure on left) or closing off these passages and directing the entire stream out through the mouth (as shown on right). Two mirrors placed, one under the nose, the other before the mouth, catch the breath and thereby indicate the relative strength of the two streams.

Dr. Glover using his transmitter with nose-piece attachment.

Moving Pictures at Home

THE public entertainment possesses this disadvantage that it must suit a heterogeneous assembly of people of varied interests and tastes. Consequently, its programme must be made up of a variety of subjects which may not altogether satisfy any one of the audience or spectators. If the entertainment is a concert a disappointed listener can at least go home and make up the deficiency with his own piano, player piano or phonograph; or on the other hand if one has heard something that particularly strikes his fancy he may purchase the selection and reproduce it to his heart's content at home. In the case of the moving picture show, however, the spectator is obliged to accept a "table d'hote" programme even though prepared for a public whose tastes are absolutely at variance with his own, on the chance of witnessing now and then a selection that he finds interesting and instructive. But he cannot reproduce these selections or make up his own programme at home; at least he has not been able to do so heretofore, for the reason that up to the present time there have been no practical cinematographs for home use. Although a machine of this character was placed on the market a year or two ago, it was found deficient in a number of respects and was finally withdrawn by the manufacturer. Now, however, a hand operated home cinematograph has just been put on the market which is very promising. It is manufactured by a well known foreign cinematograph company and has already met with great success abroad. The machine is shown in the accompanying photograph.

One of the first questions that occurs to a man who is contemplating the introduction of a cinematograph into his home is the danger of fire. The new machine employs fireproof films made of acetyl cellulose and to make sure that the owner may not attempt to use the highly inflammable films of the commercial machine, it is designed to take a special form of film which can be had from the manufacturers only.

The source of light is another important question. In the machine which was withdrawn from the market because it proved to be impracticable, a carbon arc lamp was employed. This called for much heavier current than could be obtained without a special circuit. In the new cinematograph no connection with the lighting circuit is necessary for the machine generates its own current in sufficient quantity to light a small osram lamp.

The generator, which is in the form of a magneto, may be seen in the foreground of the accompanying photograph. It is operated through suitable gearing by a crank handle and is fitted with a governor to prevent excessive velocity of the armature. The osram lamp is placed in small light-tight casing fitted with a reflector and condenser. So little heat is generated that there is no possible danger of injuring the film, particularly when we realize that the flow of current and feed of the film are effected by one and the same crank handle so that the film cannot be stalled without arresting the flow of current as well.

The film is given an intermittent motion in front of the lamp by mechanism similar to that employed in the commercial machine. Very little effort is required to operate the machine. It projects a picture measuring about three by four feet at a distance of ten or twelve feet, the exact dimensions depending, within limits, upon the distance of the screen from the camera. Hence the machine may conveniently be used in the ordinary parlor or sitting-room. A large library of films has already been prepared for this machine, including in addition to those of the customary dramatic and vaudeville type of exhibition, a wide variety of educational subjects, which should make an instrument of this sort particularly valuable in the class room.

An Intensifier for Telephone Transmission

By Jacques Boyer

HAS it ever occurred to the reader that there is something very artificial about our present method of speaking over the telephone? The mouthpiece is so constructed that it gathers only those sounds which proceed directly from the mouth, whereas in actual speech, a not inconsiderable portion of the sounds emitted are carried more or less completely through the nose. All such sounds must be almost completely lost in an ordinary telephone conversation, and we can therefore not be surprised if the voice carried

over the wires, although recognizable to one accustomed to the instrument, nevertheless differs materially from that of ordinary speech.

Hitherto telephone engineers, in attacking the problem of increasing the distinctness of transmission of the voice over the telephone, have mainly concentrated their attention upon improvements in the construction of the microphone, or else upon improvements in the design of the telephone line. No one, until recently, seems to have paid much attention to the study of the human voice and its peculiarities with a view to applying the observations thus obtained for perfecting telephony. It is by starting from such a basis as this that Dr. Jules Glover has evolved an apparatus shown in our illustration, by the aid of which the sound carried over the wire is much intensified and the clearness of speech is greatly increased, a matter which is of no small importance, especially for long distance transmission.

Inasmuch as in the telephone the electric current reacts upon the magnet in the receiver, not so much by its intensity, but by the variations in its intensity, it is necessary, if the ear is to receive as perfect as possible a rendering of the sound impressed upon the transmitter, to reproduce as exactly as possible all the modulations of the voice. To realize just what this implies, we must bear in mind the construction of our throat. On issuing from the pharynx the sound waves impinge upon the soft palate, which divides them into two unequal parts, of which the one escapes through the nose, while the other issues at the mouth (see our illustration). Evidently to obtain a perfect result, it is necessary that each of these two groups of sound waves be transmitted in proper proportion over the telephone, while as a matter of fact, the instruments in common use transmit almost exclusively the mouth waves, so that nearly one half of the voice remains unutilized. This is not a mere guess, but can be actually proved experimentally by recording by photographic means the variations in the intensity of the microphone current, which can be done by the aid of an oscillograph; a simpler means to effect the same end, perhaps less perfectly, is to observe the condensations of the breath from the mouth and nose by means of mirrors or other suitable devices. It is found that the records so obtained for the mouth and nose differ for the same word, according to loudness of speech.

In the improved telephone invented by Dr. Glover, contrary to the usual custom, the entire voice assists in producing the electro-magnetic phenomena by the aid of which speech is transmitted. The new apparatus differs from the customary form in that it possesses two microphone transmitters one for the mouth and one for the nose, each of properly adjusted sensibility. The couple of mouthpieces is attached to a handle as in the ordinary telephone.

Microphones of this kind can be used directly in the primary without conversation battery and without induction coil. The apparatus functions perfectly by the use of a single central battery, giving 24 volts or less. The uniform resistance has a total of 150 ohms, which, however, can be adjusted to suit circumstances. The induction coil can be omitted as the variations in the intensity of the current due to the voice are found to be sufficiently accentuated without it. Nevertheless, transmission is somewhat assisted by the use of the coil.

As a matter of hygiene, a roll of tissue paper may be passed in front of the mouth and nose to prevent any possible infection, the tissue paper being renewed automatically at each call.

A School Girl Inventor.—A school girl attending the Business High School in Washington City realizing the need of a pocket, notwithstanding fashions decree to the contrary, recently appeared at school in a collar of her own invention in which she had formed pockets at either side. One pocket was adapted for carrying small change and the other for carrying a lead pencil or similar small articles.

The Supreme Court of the United States on Price Maintenance

THE right of the patentee to fix the retail price of articles embodying his invention and to treat as an infringement of his patent any attempt to sell at other prices has now been squarely passed upon by the Supreme Court of the United States in Bauer & Co. and the Bauer Chemical Company v. James O'Donnell. In legal history this will be known as the Sanatogen Case. The decision of the Supreme Court is of immense importance to the public, to retailers and to manufacturers. It denies absolutely the right of a patentee to control the selling price of his product after it leaves his hands. The following is an abstract of the decision.—EDITOR.]

The right to make, use and sell an invented article is not derived from the patent law. This right existed before and without the passage of the law and was always the right of an inventor. The act secured to the inventor the *exclusive* right to make, use and vend the thing patented, and consequently to prevent others from exercising like privileges without the consent of the patentee. Bloomer v. McQuewan, 14 How., 539, 549; Continental Paper Bag Company v. Eastern Paper Bag Company, 210 U. S., 405, 425. It was passed for the purpose of encouraging useful invention and promoting new and useful improvements by the protection and stimulation thereby given to inventive genius, and was intended to secure to the public, after the lapse of the exclusive privileges granted, the benefit of such inventions and improvements. With these beneficent purposes in view the act of Congress should be fairly or even liberally construed; yet, while this principle is generally recognized, care should be taken not to extend by judicial construction the rights and privileges which it was the purpose of Congress to bestow.

In framing the act and defining the extent of the rights and privileges secured to a patentee Congress did not use technical or occult phrases, but in simple terms gave an inventor the exclusive right to make, use and vend his invention of a definite term of years. The right to make can scarcely be made plainer by definition, and embraces the construction of the thing invented. The right to use is a comprehensive term and embraces within its meaning the right to put into service any given invention. And Congress did not stop with the express grant of the rights to make and to use. Recognizing that many inventions would be valuable to the inventor because of sales of the patented machine or device to others, it granted also the exclusive right to vend the invention covered by the letters patent. To vend is also a term readily understood and of no doubtful import. Its use in the statute secured to the inventor the exclusive right to transfer the title for a consideration to others. In the exclusive rights to make, use and vend, fairly construed, with a view to making the purpose of Congress effectual, reside the extent of the patent monopoly under the statutes of the United States. Bloomer v. McQuewan, 14 How., 549.

The case presented pertains to goods purchased by jobbers within the District of Columbia and sold to the appellee at prices not stated, and resold by him at retail at less than the price of one dollar fixed in the notice. The question therefore now before this court for judicial determination is: May a patentee by notice limit the price at which future retail sales of the patented article may be made, such article being in the hands of a retailer by purchase from a jobber who has paid to the agent of the patentee the full price asked for the article sold?

The object of the notice is said to be to effectually maintain prices and to prevent ruinous competition by the cutting of prices in sales of the patented article. That such purpose could not be accomplished by agreements concerning articles not protected by the patent monopoly was settled by this court in the case of Dr. Miles Medical Company v. Park & Sons Company, 220 U. S., 373, in which it was held that an attempt to thus fix the price of an article of general use would be against public policy and void. It was doubtless within the power of Congress to confer such right of restriction upon a patentee. Has it done so? The question has not been determined in any previous case in this court, so far as we are aware. It was dealt with under the copyright statute, however, in the case of Bobbs-Merrill Company v. Straus, 210 U. S., 339. In that case it was undertaken to limit the price of copyrighted books for sale at retail by a notice on each book fixing the price at one dollar and stating that no dealer was licensed to sell it for less and that a sale at a less price would be treated as an infringement of the copyright. It was there held that the statute, in securing to the holder of the copyright the sole right to vend copies of the book, conferred a privilege which, when the book was sold, was exercised by the holder, and that the right secured by the statute was thereby exhausted. The court also held that it was not the purpose of the law to grant the further right to qualify the title of future purchasers by means of the printed notice affixed to the book, and that to give such right would extend the statute beyond its fair meaning and secure privileges not intended to be covered by the act of Congress.

Section 4952 Revised Statutes, a part of the copyright act, secures to an author, inventor, designer or proprietor of books, maps, charts or dramatic or musical compositions the sole liberty of printing, reprinting, publishing, completing, copying, executing, finishing and vending them. While that statute differs from the patent statute in terms and in the subject matter intended to be protected, it is apparent that in the respect involved in the present inquiry there is a strong similarity between and identity of purpose in the two statutes. In the case of patents the exclusive right to vend the invention or discovery is added to the like right to make and use the subject matter of the grant, and in the case of copyrights the sole right of multiplying and reproducing books and other compositions is coupled with the similar right of "vending the same." So far as the use of the terms "vend" and "vending" is concerned, the protection intended to be secured is substantially identical. The sale of a patented article is not essentially different from the sale of a book. In each case to vend is to part with the thing for a consideration.

It is apparent that the principal difference in the enactments lies in the presence of the word "use" in the patent statute and its absence in the copyright law. An inventor has not only the exclusive right to make and vend his invention or discovery, but he has the like right to use it, and when a case comes fairly within the grant of the right to use, that use should be protected by all means properly within the scope of the statute.

Chief reliance, however, of the plaintiff in this case is upon the recent decision of this court in Henry v. Dick Company, 224 U. S., 1. An examination of the opinion in that case shows that the restriction was sustained because of the right to use the machine granted in the patent statute, distinguishing in that respect the patent from the copyright act. In that case a patented mimeograph had been sold which bore an inscription in the form of a notice that the machine was sold with the license restriction that it might only be used with stencil, ink and other supplies made by the A. B. Dick Company, the owners of the patent. The alleged infringer sold to the purchaser of the mimeograph a can of ink suitable for use with the machine with full knowledge of the restriction and with the expectation that the ink sold would be used in connection with the machine. It is expressly stated in the opinion that the machine was sold at cost or less and that the patentee depended upon the profit realized from the sale of the non-patented articles to be used with the machine for the profit which he expected to realize from his invention (224 U. S., 26). After commenting upon the copyright statutes and the resemblance between the author's right to vend copies of his work and the patentee to vend copies of his work and the patentee's right to vend the patented thing, it was said (page 46):

"To the inventor, by Section 4884, Revised Statutes, there is granted 'the exclusive right to make, *use* and vend the invention or discovery.' This grant, as defined in Bloomer v. McQuewan, 14 How., 539, 549, 'consists altogether in the right to exclude every one from making, *using* or vending the thing patented.' Thus, there are several substantive rights, and each is the subject of subdivision, so that one person may be permitted to make, but neither to sell nor use the patented thing. To another may be conveyed the right to sell, but within a limited area, or for a particular use, while to another the patentee may grant only the right to make and use, or to use only for specific purposes. Adams v. Burke, 17 Wall., 453; Mitchell v. Hawley, 16 Wall., 544; Rubber Company v. Goodyear, 9 Wall., 788, 799." (*Italics* in the original opinion.)

That case was distinguished from Bobbs-Merrill versus Straus, construing the copyright act, because of the difference in the terms of the copyright and patent statutes, the patent act conferring not only the right to make and sell, but the exclusive right to *use* the subject matter of the patent. It was under the right to use that the license notice in question was sustained, and it is obvious that the notice in that case dealt with the use of the machine and limited it to use only with the paper, ink and supplies of the manufacture of the patentee. While the title was transferred, it was a qualified title, giving a right to use the machine only with certain specified supplies. It was said in the Dick case that "there is no collision whatever between the decision in the Bobbs-Merrill case and the present opinion. Each rests upon a construction of the applicable statute, and the special facts of the cases."

It is contended in argument that the notice in this case deals with the use of the invention, because the notice states that the package is licensed "for sale and use at a price not less than one dollar," that a purchase is an acceptance of the conditions, and that all rights revert to the patentee in event of violation of the restriction. But in view of the facts certified in this case, as to what took place concerning the article in question, it is a perversion of terms to call the transaction in any sense a license to use the invention. The jobber from whom the appellee purchased had previously bought, at a price which must be deemed to have been satisfactory, the packages of Sanatogen afterward sold to the appellee. The patentee had no interest in the proceeds of the subsequent sales, no right to any royalty thereon or to participation in the profits thereof. The packages were sold with as full and complete title as any article could have when sold in the open market, excepting only the attempt to limit the sale or use when sold for not less than one dollar. In other words, the title transferred was full and complete with an attempt to reserve the right to fix the price at which subsequent sales could be made. There is no showing of a qualified sale for less than value for limited use with other articles only, as was shown in the Dick case. There was no transfer of a limited right to use this invention, and to call the sale a license to use is a mere play upon words.

The real question is whether in the exclusive right secured by statute to "vend" a patented article there is included the right, by notice, to dictate the price at which subsequent sales of the article may be made. The patentee relies solely upon the notice quoted to control future prices in the resale by a purchaser of an article said to be of great utility and highly desirable for general use. The appellee and the jobbers from whom he purchased were neither the agents nor the licensees of the

(*Concluded on page 547.*)

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

NECKTIE CASE.—T. P. FORMAN, Circuit Ave., Waterbury, Conn. The invention pertains to improvements in necktie cases, and the object is to provide an improved structure which is adapted to be folded so that the respective ties will face each other and all the ties be covered when the case is closed.

HEATER FOR HAT BRIMS.—M. HERSHKOWITZ and J. FRIEDMAN, 715 Jackson Ave., Bronx, N. Y. The invention provides a heater for brims, adapted to concentrate the heat thereon and to avoid undue heating of the crown; and provides means for suspending the hat above a radiating plate to avoid burning the hat during the process of heating the brim.

Electrical Devices.

ELECTRIC SOLDERING IRON.—F. M. GIFFEN, 219 Sequin St., San Antonio, Tex. This inventor provides a soldering iron having a receptacle for the solder, from which the melted solder may be delivered as desired. He also provides novel means for permitting the flow of solder and for shutting it off.

MAGNETIC SWITCH.—C. G. MILLER, 156 W. 65th St., Manhattan, N. Y., N. Y. The invention has particular reference to a magnetically operated device which is adapted for the operation of any element through magnetic influence, said element to be operated in the opposite direction when the magnetism ceases, either by gravity or some other means.

Of Interest to Farmers.

TETHER.—H. L. DUXSTAD, Cambridge, Wis. This invention provides a device by means of which an animal may be tethered to a stake, but which will prevent injury to the animal such as that often occasioned by entanglement with the rope. By means of the device a rope which forms one of the tethering members may be kept always taut and out of the way of the animal.

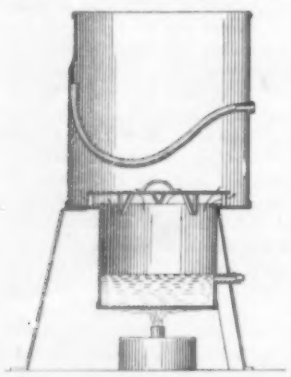
MIXING TANK.—C. E. MINCER, Hamburg, Iowa. The invention is for the mixing of Bordeaux solution for use in spraying orchards, vineyards and field crops. It provides for effecting the mixture in the tank of the wheeled sprayer, whereby it is necessary only to have barrels of stock solution at points in the orchard where water is available, thereby doing away with expensive and cumbersome fixed series of tanks.

SAP COLLECTING APPARATUS.—G. H. SOULE, Fairfield, Vt. Among the principal objects in view in this invention are: to provide an apparatus having means for suspending and covering the sap-collecting bucket, and to provide means for preventing the withdrawal of the support for said apparatus.

COMBINED PNEUMATIC LIFT AND FORCE PUMP.—F. O. DE HYMEL, 110 Soledad St., San Antonio, Tex. This apparatus is particularly adapted for irrigating tracts of 10, 20, 50, or even 100 acres, and for lifting water from various depths. It may be easily and quickly shifted from one well or a series of wells to another, and thus an effective irrigation maintained throughout the dry months with little labor and expense. It is particularly adapted for use in the semi-arid regions of the West, Mexico, and other places, and also with draft horses.

Of General Interest.

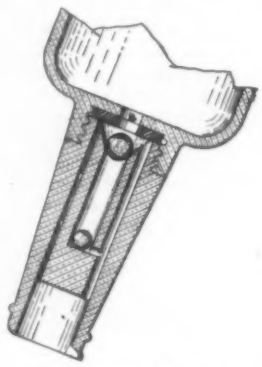
HEAD STEAMING APPARATUS.—A. F. KNIESCHE, 2538 Frederick Ave., Baltimore, Md. In use the steam rising from the lower vessel is deflected toward the sides of the steaming chamber to permit the steam or vapors to



HEAD STEAMING APPARATUS.

come in contact with the head of a person preferably covered during the steaming operation with a piece of cloth, rubber or the like extending over the upper open end of the steaming vessel above. By means of a deflector the water boiling in the lower vessel is not liable to come into contact with the face and hence burning thereof is prevented.

NON-REFILLABLE BOTTLE.—J. G. TAYLOR and C. T. EATON, 185 Franklin St., Boston, Mass. The invention refers to storage vessels provided with means for preventing refilling the same; and it comprises features whereby the inflow of liquid after the vessel



NON-REFILLABLE BOTTLE.

has been emptied is effectually prevented. These features include a member acting as a valve to check the inflow of liquid, this member being buoyant so that it will be carried against the edge of the opening through which the liquid must pass to enter the interior of the vessel and effectually close this opening.

NECK FOR BANJOS OR THE LIKE.—O. SCHMIDT, 87 Ferry St., Jersey City, N. J. This invention relates to banjos and similar musical instruments, and its object is to provide an improved fastening device, more especially designed for securely and quickly fastening the rim to the neck of the instrument.

PICK HOLDER.—S. YOUNG, Cedar Point, Ill. This invention relates to means for handling miners' picks, and has particular reference to a device whereby a number of picks may be clamped together in a bundle and handled in large numbers without danger of breakage of the handles or otherwise damaging the picks.

DETACHABLE ANCHOR BOLT.—C. BUTLER, 1170 Broadway, N. Y., N. Y. This improvement refers to fastening devices adapted especially for concrete building constructions. An object is to devise an anchoring means which will be more reliable in use by reason of its positive connection with the concrete construction than devices heretofore proposed for this purpose.

FIRE EXTINGUISHER.—S. L. HARWOOD, Dublin, Ga. This improvement comprises features of construction by means of which the likelihood of the extinguisher being injured or made to operate when not needed, by rough handling, is practically eliminated, while at the same time the device remains capable of being put to an instant use when occasion arises.

TYPE GUARD.—W. G. MACMILLAN, 268 W. 141st St., New York, N. Y. The ends of the type guard are held yieldingly extended, so that the type guard may be disposed between reglets for holding the type set between the reglets in position, and without it being necessary to fill the space between the reglets and between the type with furniture and quoins. One or more of these guards may be arranged for holding type and cuts in position, when the type is set and cuts are arranged for display.

FILTER.—E. SEAVEY, 116 W. 102nd St., New York, N. Y. This invention relates to filters such as in the Letters Patent of the U. S. No. 1,035,248, granted to Mr. Seavey. The present invention is arranged to insure thorough straining of the sediment or other foreign matter contained in the liquid to be filtered, and to permit of readily cleaning the filter when desired.

COIN AND MAIL HOLDING DEVICE FOR MAIL BOXES.—J. E. SHINN, R. F. D. No. 2, Box 26, Conway Springs, Kan. This is an improvement in devices for holding coins, post cards and letters in mail boxes, and the device may be placed on the interior of any mail box and will permit a postman to pick up letters or postals or to take out the coin without the necessity of removing his gloves to do so.

Hardware and Tools.

HOSE COUPLING.—V. S. PERAZIO, 1032 Monroe Ave., Detroit, Mich. The more particular purpose of this invention is the provision of a type of hose coupling suitable for use by fire departments, and of such construction that the two adjacent ends of consecutive hose sections may be quickly and securely gripped together.

SUGAR SAMPLER.—J. N. REED, 92 Morningside Ave., New York, N. Y. The design of the invention is to provide a sampler of such form that the device may be entered into sugar bags when the latter are piled up, under which conditions it is exceedingly difficult to cause triers of ordinary form to penetrate the bags of sugar, the pressure resulting from the piling of the bags offering a great resistance to the entrance of the trier.

SAFETY RAZOR.—C. G. BLUH, 868 Willoughby Ave., Brooklyn, N. Y. This invention provides a blade and holder co-acting therewith for positively holding the blade in proper position against accidental movement. It provides a guard plate designed to accommodate a blade formed with a slot, and also a clamping member passing through the eyelet and pressing against the blade for holding the same firmly against the guard plate.

PEAVEY OR CANT HOOK.—A. LAMBERT, care of J. F. T. B. Brentano, St. Paul, Ore. The invention has particular reference to a peavey or cant hook used by lumbermen which comprises a cylindrical handle provided at one end with a slightly tapering metal ferrule supporting the hook proper at one side and intermediate its ends, and having a spur at its extremity.

LOCK.—H. S. HASHIM, Lents, Ore. In this case the invention is an improvement in locks, and the object is to provide a device simple in construction and operated by push buttons to open and to close the same, and having means for locking the bolt in extended position.

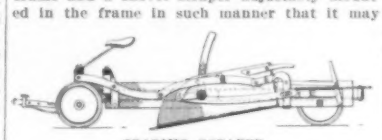
Household Utilities.

INVALID BED.—W. C. FEELY, 379 First Ave., Manhattan, N. Y., N. Y. The invention provides a bed which may be disassembled or knocked down for storage or handling; provides means for elevating the body of a patient, or parts thereof, to vary the position of the patient; provides means for suspending the patient above the bed proper, to facilitate changing of bed furnishings; and provides commode-supporting means for operating the same.

WINDOW CLEANER.—HENRIETTA K. PARKE, R. 110 Vendome Hotel, Chicago, Ill. This invention provides a cleaner with a base and inner and outer standards hinged thereto, so that the base may be disposed on a window sill, and the standards may be erected to vertical positions one at outside the other at inner side of the window, cleaner members being provided which are mounted on guides for traveling on standards, the guides being supported by means for moving the two guides simultaneously in the same direction.

Machines and Mechanical Devices.

GRADING SCRAPER.—J. F. THOMAS and J. HANEY, care of J. C. Gans, Odessa, Minn. The object of the inventors is to provide a wheeled frame and a shovel scraper adjustably mounted in the frame in such manner that it may



GRADING SCRAPER.

be caused to scrape and remove the surface of the soil beneath the frame when the latter is moved, and may be further adjusted to a position wherein its contents may be either dumped as a whole or gradually leveled out after transportation to a desired point.

CLEANER FOR FIREARM BARRELS.—M. W. P'POOL, Winters, Tex. Mr. P'Pool in his invention has for an object the provision of a cleaner for firearm barrels, which may be conveniently carried in the pocket, and which may be used for cleaning firearms of the repeating type having ejector slots too short to admit of the use of cleaners now on the market.

INDICATING MECHANISM FOR TIMEPIECES.—O. E. GISET, care of Messrs. A. Wittnauer & Co., 30 W. 36th St., New York, N. Y. The invention provides indicating mechanism for watches, clocks, etc., and arranged to indicate the wound up state or condition of the main spring; that is, to enable the user to see at a glance whether the timepiece is wound or not, at the same time enabling the user to correctly and fully wind up the piece without danger of over-winding and breaking the main springs.

WASHING MACHINE FOR MILK SEPARATOR DISKS.—H. G. BEMIS, Riceville, Iowa. The invention provides a machine adapted to be handled as a portable member, provides a machine with a loading member adapted for handling as a carrier for the disks prior to loading; provides a brush for operation upon the edge portion of the disks; and provides means whereby the loading member is held centrally in the machine.

SEPARATING MACHINE.—M. W. TERYRICÁ, Rua Tamandare 194, Sao Paulo, Brazil. The invention comprehends an apparatus whereby the material such as coffee, cereals, etc., to be assorted or graded may be fed continuously into the machine, and through the aid of a number of separating sieves a grading may be effected, the grading material being discharged through separate chutes into separate bins.

ECCENTRIC BALANCE COMPUTING SCALE.—E. PIERSON, Rollwitz, Neb. This invention is an improvement in eccentric balance computing scales, and has for its object the provision of simple, easily operated means for weighing an article, and for indicating not only the weight of the said article, but also the price of the same in money.

Railways and Their Accessories.

TRIP STANCHION FOR LAGGING CARS.—V. L. MORRIS, R. F. D. No. 2, Box 24, Biloxi, Miss. An object here is to provide a trip which may be operated from the opposite side of the car from that from which the logs are to be unloaded. A further object is to provide means for locking the trip in its operative position and for unlocking it without the necessity of the application of a tool.

FREIGHT CAR LADDER.—W. A. MITCHELL, care of M. K. & T. R. R., Sedalia, Mo. The invention provides ladders for the sides and ends of freight cars, which are in conformity with the United States safety appliance law, and which possess features that render these ladders safer than the ordinary ones.

SWITCH OPERATING MECHANISM.—E. J. KNOWLTON, 228 Old 5th St., Birmingham, Ala. In the present patent the invention is an improvement in switch operating mechanism and particularly in that class of such mechanism wherein the devices for moving the switch are operated from a moving locomotive or car.

Pertaining to Recreation.

GAME.—J. GREENE, 216 E. Broadway, Salt Lake City, Utah. This invention relates to game apparatus and has particular reference to this character of apparatus in making use of a board having a plurality of grooves or channels and a plurality of moving members or disks arranged in a number of sets of different colors.

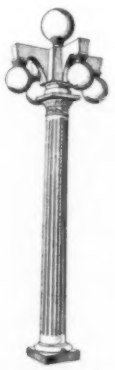
Pertaining to Vehicles.

COKE AND COAL WAGON.—M. L. SENDERLING, 333 Fairmount Ave., Jersey City, N. J. This wagon is of the hopper bottom type of vehicles and has one or more compartments, the compartments adapted to be separately discharged, and the load of each compartment being delivered out of the outside of the wheel base and substantially in bulk.

GARDENER'S WHEEL CHAIR.—IDA M. PETERS, Pleasant Valley, N. Y. By means of this convenient chair, berries or vegetables growing at different heights from the ground may be easily picked without the person getting off the chair, which can be easily guided and propelled while sitting on same, and in which the wheel base is such as to run on the paths running along the sides of rows or beds of vegetables or berries.

Designs.

DESIGN FOR A STREET LIGHT STANDARD.—J. McL. PETTYJOHN, care of the Pettyjohn Co., Terre Haute, Ind. The grooved



STREET LIGHT STANDARD.

column in this design stands upon a plain base and supports four arms, pendent from each of which is a round globe. Capping the arms and in their center is an upright globe materially larger than the others.

DESIGN FOR CARPET OR RUG.—W. E. SAYERS, care of G. S. Squire, 25 Madison Ave., New York, N. Y. Mr. Sayers has designed three carpet or rug designs Nos. 43,945, 43,946, and 43,947. Each one has a border comprising several neat and beautifully patterned bands. The first and third have center designs of very small conventional figures, while the second has a field of vines, flowers, and leaves amid a geometrical composition.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Inquiry No. 9310. Wanted addresses of manufacturers of good selling articles for mail order business catering to the trade of agents.

Inquiry No. 9311. Wanted names and addresses of manufacturers of hatpin heads made of colored glass; also medals of all shapes.

Inquiry No. 9312. Wanted to buy a machine which will pick up a weight the size of a lima bean by vacuum process. Must be able to pick up dust, gravel, etc. Must be operated by electricity and be easily portable.

Inquiry No. 9313. Wanted to buy Leather Held Horse Shoes used temporarily when shoe cannot be nailed on. In other words a Leather Boot with iron shoe at bottom—strapped over horse's foot.

Inquiry No. 9314. This enquirer is in the market for some patented articles which he could purchase and manufacture with an investment of from $5,000 to $10,000. The name of the party will be supplied to any of our readers on application.

Inquiry No. 9315. Wanted the name and address of a concern manufacturing novelty ink wells.

Inquiry No. 9316. Wanted the names of manufacturers and manufacturers' agents who make patented articles and other useful devices which appeal to the public and which can be used in a mail order business and by canvassers.

The Supreme Court of the United States on Price Maintenance

(Concluded from page 545.)

patentee. They had the title to, and the right to sell, the article purchased without accounting for the proceeds to the patentee and without making any further payment than had already been made in the purchase from the agent of the patentee. Upon such facts as are now presented we think the right to *vend* secured in the patent statute is not distinguishable from the right of *vending* given in the copyright act. In both instances it was the intention of Congress to secure an exclusive right to sell, and there is no grant of a privilege to keep up prices and prevent competition by notices restricting the price at which the article may be resold. The right to vend conferred by the patent law has been exercised, and the added restriction is beyond the protection and purpose of the act. This being so, the case is brought within that line of cases in which this court from the beginning has held that a patentee who has parted with a patented machine by passing title to a purchaser has placed the article beyond the limits of the monopoly secured by the patent act.

In Adams v. Burke, 17 Wall., 453, Mr. Justice Miller, delivering the opinion of the court, pertinently said (page 455):

"The vast pecuniary results involved in such cases, as well as the public interest, admonish us to proceed with care, and to decide in each case no more than what is directly in issue. . .

"The true ground on which these decisions rest is that the sale by a person who has the full right to make, sell, and use such a machine carries with it the right to the use of that machine to the full extent to which it can be used in point of time.

"The right to manufacture, the right to sell, and the right to use are each substantive rights, and may be granted or conferred separately by the patentee.

"But, in the essential nature of things, when the patentee, or the person having his rights, sells a machine or instrument whose sole value is in its use, he receives the consideration for its use and he parts with the right to restrict that use. The article, in the language of the court, passes without the limit of the monopoly. That is to say, the patentee or his assignee having in the act of sale received all the royalty or consideration which he claims for the use of his invention in that particular machine or instrument, it is open to the use of the purchaser without further restriction on account of the monopoly of the patentees."

Bloomer v. McQuewan, *supra;* Goodyear v. Beverly Rubber Company, 1 Cliff., 348, 354, 10 Fed. Cases, 638; Chaffee v. Boston Belting Company, 22 How., 217, 223; Keeler v. Standard Folding Bed Company, 157 U. S., 659.

Holding these views, the question propounded by the Court of Appeals will be answered in the negative, and

It is so ordered.

Dissenting: Mr. Justice McKENNA, Mr. Justice HOLMES, Mr. Justice LURTON and Mr. Justice VAN DEVANTER.

Five Ordnance Patents.—William D. Smith of Washington, D. C., has secured five patents, Nos. 1,055,819 to 1,055,823 inclusive. Patents No. 1,055,821 and 1,055,822 have for an object to provide means for admitting a large volume of air or other fluid between the gas check and the mushroom head without materially changing the construction of the guns now in use. Patent No. 1,055,819 seeks to provide devices for injecting powdered graphite or other dry material into the bore of the gun with the flushing fluid to coat the surface of the bore to protect it from the action of the hot gases and also to form a dry lubricant which will not be affected by the heat of the gun. The patent, No. 1,055,820, has for an object to provide a positive indicator for showing whether or not the air admitted to clear out the residue of the explosion has performed such function, the indicator also forming a locking device to prevent the opening of the breech mechanism unless the air has entered and performed its work, while the object of the mechanism shown in patent No. 1,055,823 is to provide for admitting air or other fluid to the breech of the gun immediately after the gun is fired and during the first part of the recoil movement of the gun.

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Charles E. Craven, D.D., Headmaster

The Industrial Need of Technically Trained Men—IV

Why There is Place in Business for Men Technically Trained

By John Ritchie, Jr.

THE manufacturing world of to-day depends upon the man who is technically trained. This is becoming more and more evident, and each year the scope of such men is becoming more extended, as specialists, as superintendents and managers and in administrative positions. And at the same time the call for men whose powers of observation and adaptation have been cultivated is on the increase, proof of which is the fact that for every member of the class which graduates this month at the Massachusetts Institute of Technology, whose courses were in mechanical engineering, there have been five opportunities to enter at once into business relations of consequence.

Having been in the past an employer of considerable labor, and in the older days and under older methods a manufacturer, the dependence of the business methods of to-day upon the man with technical training is the more striking to me. Further than this, it has been my good fortune to see many young men rise to important places and to realize how much of their success was due to the special education which the technical school gave to them.

There was a time, and this within the memory of men who do not consider themselves old, when the words "conservation" and "efficiency" were not in the merchant's vocabulary, and when business simply cared for itself. The goods were made in leisurely fashion by day labor; the material was bought from hand to mouth; the standard of product was a variable one, and the cost was in effect a rough guess. A price was fixed, and the merchant knew that he could sell at a profit. The man who bought a stock of goods or manufactured a storehouse full of them had simply to sit down and wait with the certainty of disposal of them to advantage to-morrow or next week. This was in the lavish days of the development of this great country, when there was plenty for everybody.

That time has passed. The man who is to be successful in manufacturing or selling merchandise or assure profit to himself even in that staple industry, agriculture, must follow scientific methods. He must be ready to compete with others who are keen-eyed and intelligent. If he is a store-keeper of old-fashioned mold, while he is waiting for his goods to sell themselves, his neighbor, who is trained in technical ways, has made improvements, so that the stock of the conservative one is out of date and suitable only for the bargain counter.

There are thus most excellent reasons why business men are turning more and more to the technical schools for young men who are usable at the outset and who may be developed along the lines of the greatest benefit to the product.

The student who has passed his four years at a technical school of the highest grade must have acquired a fundamental knowledge of chemistry and a valuable acquaintance with materials, including those most subject to manipulation. Manufacture consists practically in processes of manipulation. These processes convert the material into products more or less refined, and in the transformations there lies the opportunity for efficiency or waste.

Such schools go further and give a good foundation in mathematics; and the possibility of comparisons by tabulations and graphic diagrams, which are a sealed book to the old-school business man, give a basis whereby economy and efficiency—so far as materials go—may be estimated.

Knowledge of materials means much more in other departments of the business. A man who has knowledge of this kind can test what is offered to him. He has a means of making the raw material conform to a desired standard, and will reap the advantages that must accrue to him in the evenness and reliability of his own product. Further than this, such a man can select between materials when there is a choice. He is fitted to find new materials that may supplant the older ones, and he has the education that will permit him to add advantageous qualities to the materials that he wishes to use.

Materials, important as they prove to be, are but a portion of the story of efficiency, for there is labor and the mechanical plant. Labor is very important, for in an industry producing an article that is not of the highest excellence of finish, it may overbalance the cost of material in the ratio of say three to five. The technically trained man has already acquired the habit of studying, and it is a study to handle men. The success or failure of an establishment may depend upon the fitness of the men to the work they are expected to do. This is realized in technical schools, and already the best of them seek to strengthen their courses by adding something of the direct study of man. But fundamentally the man who studies man is the one who can place his labor most efficiently, and he does it because it is a technical problem.

There is much stress laid on efficiency when it comes to dealing with labor, and there are not a few who, in the rush of newer methods, feel that the workers must be merely machines. Here there is a substantial error, for the handling of labor, like any other acceleration, must be in harmony with the purpose. It is an injury to reduce all laborers to mere automatons. Each industry and each establishment has its own limitations. The man who is properly trained is able to study his own plant as an individual problem and to determine on its own merits, without unfortunate Procrustean standards, where scientific management may be advantageously employed.

Any one can glance over the daily papers and the special ones that have sprung up about all the industries, which may bring opportunity to any man's door, but it is not every one who has the perception to realize what these announcements may mean. Here the training of the technical school in the broadness and keenness of vision that it gives, is of great advantage.

The man with technical education will not attempt to supplant the architect in the latter's specialty, but he will be competent to consider the proper location and arrangement of his buildings, and he will know all about his prime movers and his coal pile. He will be able to rate in their true places the different factors and converge them all to the greatest benefit of the whole establishment. He will be able to estimate the value of heralded improvements and judge whether they are promising ones. He will be able to let go when older methods fail by the newer standards, and he will avoid, what is not so rare in this country, the mortification of seeing an up-to-date rival growing up in his very shadow, and absorbing his business through more efficient management.

Then again, and most certainly not to be underestimated, technical training is of the utmost value in industrial exploration. There is constantly the need of production along undeveloped lines. All kinds of business is groping, so to speak, in semi-obscurity, seeking new fields, new methods, new materials. Here it is that the man with a knowledge of the materials and a knowledge of the methods and with a mind open to catch the latest information that science has to offer him, is bound to win.

Only a quarter of a century ago it was the practical man who had worked up, who was at the head of the concern. It was the bobbin boy or the lineman who had grown to be president. To-day it is the man technically trained, the engineer. He is making his way with all speed. He is yet young. The graduates of the Massachusetts Institute of Technology, the oldest school of the kind in the country, average but thirty-five years of age. But he is growing older and is winning his spurs surely and certainly.

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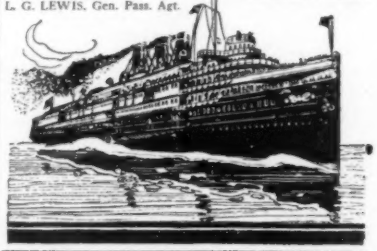

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Tests on a 10,000 Horse-power Föttinger Transformer

(*Concluded from page 536.*)

nection to recall the genesis of the Föttinger transformer: After being invented by Dr. Föttinger, late engineer of the Vulcan-Werke, the transformer was developed by this firm in conjunction with the inventor, and the first installation made in 1909, on board a wharf steamer, gave excellent results in permanent operation.

Another installation was made on an English coasting vessel designed for producer-gas motor propulsion. This transformer, designed for 150 horse-power, was tested under a maximum load of about 900 horse-power, its maximum efficiency being upward of 88 per cent.

At the beginning of the present year an order was received for a big transatlantic steamer on which the huge transformer recently tested is to be installed. This has already been followed by an order for another installation: A new vessel of 1,700 tons displacement for the North Sea health resort service, which has been ordered from the Vulcan-Werke, will be equipped with an engine plant comprising two high-speed turbines and two Föttinger transformers, each of about 3,000 horse-power.

The remarkable maneuvering capacities of the Föttinger transformer which have been demonstrated by the experimental plant on the wharf steamer, also suggested its use in connection with Diesel motor ship propulsion. Even in this field a success has already been scored, a large Belgian firm having ordered for a motor vessel intended for the Congo, two transformers each of about 550 horse-power. This installation shows the special advantage of allowing the non-reversible Diesel motors to be operated at low speeds of rotation, i. e., with a remarkable safety of operation, while the propeller shafts, in view of the smallness of the propeller, had to run at higher numbers of turns. The Föttinger transformer thus transmits in this case from a low speed to higher speeds. This type at present is being submitted to continuous tests on the Stettin testing floor of the Vulcan-Werke.

The development of Föttinger transformers for ship propulsion resulted in the adoption of the same type of gear for many applications on land. The first installations for automobiles and locomotives, the latter in connection with Diesel motors, are nearing completion, while a fine iron rolling mill, operated by a steam turbine and a Föttinger transformer, has been since September, 1912, in operation at a large industrial works. This plant may also be described as a perfect success, showing as it does a remarkable ease of control and adaptation to the heaviest and most rapid fluctuations in the load of the rolling mill. In fact, the number of turns of the rolling train could be kept constant within 6 per cent to 8 per cent between no load and maximum peak loads. The set can stand overloads up to about 2,800 horse-power on the secondary shaft and is driven at an average ratio of 1:4.8. The efficiency of this transformer can be kept practically constant at about 85 per cent within wide limits.

Apart from these large units some smaller units have been designed for the operation of blowers, lifting devices, etc.

All these applications conclusively show this type of transformer to possess a remarkable safety of operation, reached by no other gearing, up to the highest outputs and speeds of rotation. In fact, the transformer has now definitely emerged from its experimental stage and is ready for industrial exploitation on a huge scale.

Bacteriology and Your Health

(*Concluded from page 541.*)

ventive, however, a number of infections have been encountered in which the injection of *dead* bacteria has not yielded satisfactory results, and in animal experiments some of these infections have been successfully immunized against by the use of *living* bacteria. Ever since this form of treatment was introduced, at-

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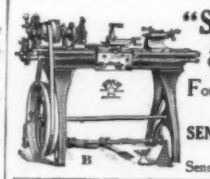
tempts have been made to apply it to the cure of tuberculosis, but the results have been most discouraging. The most recent of these attempts, that of Friedmann, is now on trial. His bacterial vaccine differs from those heretofore employed in that he uses living instead of dead tubercle bacilli. It will be recalled that Pasteur sought to produce a very mild attack of anthrax in his animals by using anthrax bacilli which had been artificially weakened. Similarly, Friedmann makes use of tubercle bacilli obtained from a turtle, which, through adaptation to the turtle, have been so changed as to be no longer virulent for man. Whether this form of treatment will prove to be successful or not remains to be seen; the results thus far are not encouraging.

In this connection it may be well to remember what has already been said concerning the strict specificity of the action of all these substances. Injections of typhoid bacilli are of no avail in the treatment of dysentery, or of cholera. Similarly in tuberculosis nothing can be hoped for from injections of bacilli merely resembling tubercle bacilli, and there is some question whether these bacilli from the turtle really belong to the same family as the true tubercle bacilli which cause consumption. But even if they are true tubercle bacilli, it by no means follows that this represents the "cure" scientists have so long been seeking. From what has gone before it is obvious that treatment with specific sera and vaccines is premised on the assumption that the development of antibodies represents *the* cure of the disease. This assumption, however, is open to criticism, for experience has taught us that with the development of the antibodies, only *one* of the curative factors has been brought into existence. To be sure, in many infections, the antibody is so important that the other factors are practically negligible. In other cases, however, something more than the mere presence of the specific antibodies is apparently needed in order to cure disease. The poor results thus far obtained with various forms of serum and vaccine treatment in tuberculosis make it likely that important causative factors remain unaffected by this form of treatment.

In concluding this brief sketch it may be added that a delicate but rather complicated serum reaction is now made use of in the diagnosis of venereal infections, and has thrown a great deal of light on the cause of such diseases as locomotor ataxia, and general paresis. Another serum test is extensively used in the examination of blood stains for medico-legal purposes; by its use human blood stains can positively be differentiated from those of the lower animals. The same test is used in the examination of sausages and the like in order to detect horse or dog flesh. A number of observers have devised methods of diagnosing cancer by means of serum reactions, but up to now none of these has proven reliable. All in all, these immunity studies have proven one of the most fruitful fields of medical research.

Three Patents for Steel Improvements.—Benjamin Talbot of Woodburn, Darlington, Eng., has secured patents Nos. 1,055,831, 1,055,832 and 1,055,833, relating to improvements in steel. The patent No. 1,055,831 is for a process of treating steel ingots for the purpose of eliminating or reducing "pipes" or cavities. In carrying out the process, the ingot is stripped from the mold while its interior is still fluid and the ingot is heated to soften its outer strata and then squeezed to reduce its cross sectional area at the top. The patent No. 1,055,833 is along the line of No. 1,055,831, with improvements including the rolling of the ingot into the shape of a rail. The patent No. 1,055,832 makes a steel rail or other shape with a purified central part lower in carbon than the outer strata, thus improving the structure to free it from flaws and defects and give it a uniformly tough interior lower in carbon than the outer part.



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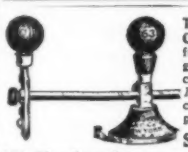

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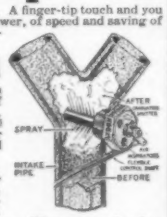

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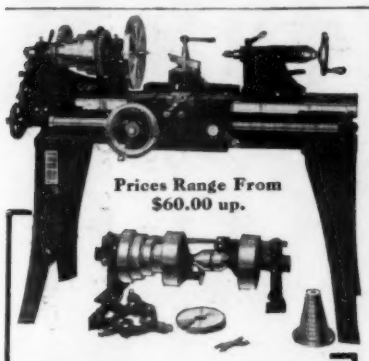

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NEW BOOKS, ETC.

THE INTERPRETATION OF DREAMS. By Prof. Sigmund Freud, LL.D. Authorized Translation of the Third Edition. With Introduction by A. A. Brill, Ph.D., M.D. New York: The Macmillan Company. 8vo.; 510 pp.

The publication of an excellent translation of Freud's "Interpretation of Dreams" may be regarded as an event for English and American students of psychology who are unable to read German with ease. No psychological theory has been advanced in recent years which has attracted so much attention and which has roused so much discussion as Freud's theory of dreams. It is almost impossible to pick up a German psychological periodical of the last five years without finding in it at least one reference either strongly approving or disapproving of Freud's views. The mere facts that the European psychological world is divided into two camps with respect to the acceptance or rejection of Freud's doctrines, shows that we are dealing with a momentous announcement.

In the space of such a brief review as this, it is difficult, if not impossible, to present even a cursory survey of Freud's studies. Freud holds that dreams have as their innermost meanings wish-fulfillment and wish-fulfillment only. His opponents think fears, anxieties, and antipathies are equally primitive and equally prone to appear as the inner meaning of dreams. Moreover, they are inclined to differ with him and his followers on the point that the wishes forming the dream thoughts or latent contents of dreams are always of a sexual nature. Freud himself does not go so far as this, although he is inclined to think it probable. This would follow from the fact that he approached the problem of dreams from the side of abnormal psychology. Having been led by his studies on hysteria to a new theory of the nature and workings of the unconscious mind in this class of mental disorders, he then found that the same theory could be made to include the dreams of normal persons, the dreams corresponding with the symptoms of the hysteric in being disguised fulfillment of repressed and therefore unconscious wishes or tendencies. And since he found that these wishes in the case of the hysteric were invariably of a sexual nature, dating from early childhood, he was tempted to the view that the wishes fulfilled in dreams are generally sexual wishes, and his disciples contend that the results of psycho-analysis applied to thousands of dreams, bear out this theory. There can be little doubt that sexuality, taken in the wide sense in which the Freudians use the term, plays a much more important part in the mental life of the individual and of the race than is generally recognized. Freud has made a most valuable contribution to psychology in emphasizing its significance and supporting his theory by such a wealth of concrete facts.

LA MER. Fascicules 16 à 20. Paris: Librairie Larousse, 1913.

These installments of La Mer take up the subjects of torpedoes, torpedo boats, submarines of all types, life on board a warship, organization of the French naval personnel, description of a merchant vessel both of the sailing and steaming types, the launching of a ship, description of a modern ocean liner, a deep-sea fishing vessel, deep sea fishing in general, and life of the deep-sea fishermen. The articles are all written in a popular vein, and yet seem to be quite authoritative.

THE SOLDIER'S FOOT AND THE MILITARY SHOE. A Handbook for Officers and Non-commissioned Officers of the Line. By Edward Lyman Munson, A.M. M.D., Major, Medical Corps, United States Army. Fort Leavenworth, Kansas, 1912. 8vo ; 147 pp ; illustrated.

Major Munson was president of the Army Shoe Board, which made a critical study of the feet of some two thousand soldiers. In the chapter on "The Anatomy and Use of the Foot" the intricacy of this much-abused member is most clearly established, and the result of interference with the normal anatomical relations of even its minor mechanism is pointed out. The final chapters on the care of the feet and of the shoes make for improved conditions, and might be profitably perused not only by military officers, for whom the work is primarily intended, but also by letter carriers, policemen, and the walking public.

ELEMENTS OF HYDRAULICS. A Text-Book for Secondary Technical Schools. By Mansfield Merriman. New York: John Wiley & Sons, 1912. 12mo.; 156 pp. Price, $1 net.

The aim of the book is to impart a knowledge of hydraulics to those students who have only high school preparation, and the higher branches of mathematics have not been drawn upon. At the same time, most of the essential principles and methods have been covered, although the limitations of the students for whom it is written have made it necessary to treat certain topics rather briefly, and to ignore some few others altogether.

BOILER EXPLOSIONS, COLLAPSES, AND MISHAPS. By E. J. Rimmer, M.Eng., B.Sc. With an Introduction by A. A. Hudson, Esq., K.C. New York: D. Van Nostrand Company, 1912. 8vo.; 135 pp. Price, $1.75 net.

The work is a summary of the causes of boiler explosions and the recommendations for their prevention contained in the reports of the British Board of Trade from 1882 to 1911. There is also a statement of what the British law requires of boiler users, and of their liabilities under the boiler explosions acts. It is in the first part of the work that American interests would center, and here the information concerning the use and misuse of boilers should certainly prove of benefit and serve as a preventive to mishap.

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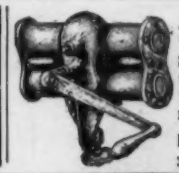

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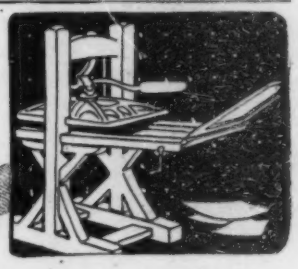

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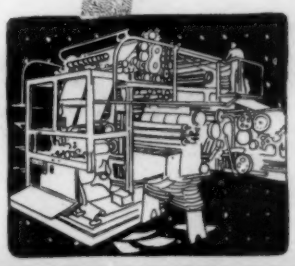

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